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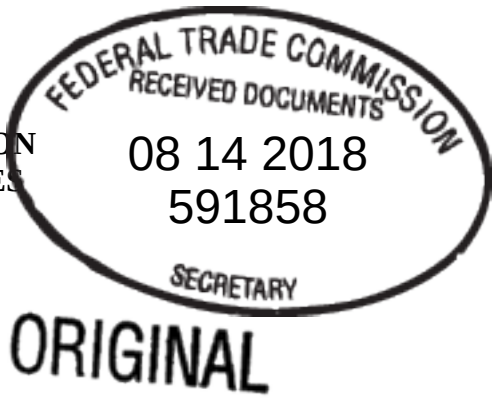

ORIGINAL

UNITED STATES OF AMERICA
BEFORE THE FEDERAL TRADE COMMISSION
OFFICE OF ADMINISTRATIVE LAW JUDGES

In the Matter of

Tronox Limited
a corporation,

National Industrialization Company (TASNEE)
a corporation,

National Titanium Dioxide Company Limited (Cristal)
a corporation,

And

Cristal USA Inc.
a corporation.

PUBLIC

Docket No. 9377

COMPLAINT COUNSEL'S POST-TRIAL PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW

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Dated: August 14, 2018

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I. JURISDICTION

1. Tronox Limited ("Tronox") and Cristal USA Inc. engage in activities in or affecting "commerce" as defined in Section 4 of the FTC Act, 15 U.S.C. § 44, and Section 1 of the Clayton Act, 15 U.S.C. § 12. (JX0001 at 001 (Joint Stipulations of Jurisdiction, Law, and Fact)).

II. BACKGROUND

A. Proposed Transaction

2. On February 21, 2017, Tronox announced a definitive agreement to acquire Cristal's TiO2 business for $1.673 billion of cash plus Class A ordinary shares representing 24 percent ownership in Tronox post-transaction. (JX0001 at 002 (Joint Stipulations of Jurisdiction, Law, and Fact)).

3. The transaction, including equity, was valued at $2.215 billion on February 17, 2017, the last trading day prior to the public announcement of the Proposed Transaction. (PX9021 at 003 (Tronox SEC FORM PREM14A)).

B. Merging Parties

4. Tronox is a publicly traded company headquartered in Stamford, Connecticut. (JX0001 at 001 (Joint Stipulations of Jurisdiction, Law, and Fact)).

5. Tronox owns and operates three chloride TiO2 plants, which are located in Hamilton, Mississippi, Botlek, Netherlands, and Kwinana, Australia. (PX9040 at 010 (Tronox investor presentation)).

6. Tronox owns and operates titanium feedstock mining and smelting assets to produce titanium slag in South Africa. (PX9040 at 010 (Tronox investor presentation)).

7. Tronox owns and operates titanium feedstock mining assets and a titanium feedstock plant producing synthetic rutile in Chandala, Australia. (PX9040 at 010 (Tronox investor presentation)).

8. Three legal entities collectively represent "Cristal." Cristal USA Inc. is a Delaware corporation and an indirectly owned subsidiary of Saudi Arabian companies The National Industrialization Company ("Tasnee") and The National Titanium Dioxide Company. (JX0001 at 001 (Joint Stipulations of Jurisdiction, Law, and Fact)).

9. Cristal owns and operates five chloride TiO2 plants, two of which are located in Ashtabula, Ohio, one in Yanbu, Saudi Arabia, one in Stallingborough, United Kingdom, and one in Bunbury, Australia. (PX9040 at 010 (Tronox investor presentation); PX7008 (Hewson, Dep. at 11) (*in camera*)).

10. Cristal owns and operates three sulfate TiO2 plants, located in Thann, France, Bahia, Brazil, and its Tikon plant located in China. (PX9040 at 010 (Tronox investor presentation); PX7008 (Hewson, Dep. at 11-12) (*in camera*)).

11. Cristal owns and operates titanium feedstock mining assets in Australia, formerly known as Bemax. (PX9040 at 010 (Tronox investor presentation); PX7006 (Stoll, IHT at 42) (*in camera*)).

12. Cristal owns and operates a titanium feedstock mining asset in Paraiba, Brazil. (PX9040 at 010 (Tronox investor presentation); PX0002 at 024 (Cristal's Narrative Response to the Second Request) (*in camera*)).

13. Cristal owns a titanium feedstock smelter in Jazan, Saudi Arabia {[redacted]} (PX7018 (Trabzuni, Dep. at 179-80) (*in camera*)).

C. Titanium Dioxide (TiO2)

14. TiO2 is an essential pigment used to add whiteness, brightness, opacity and durability to paints, industrial and automotive coatings, plastics, and other specialty products. (Young, Tr. 642; Pschaidt, Tr. 965; PX3011 at 012 (Kronos Investor Presentation); PX9020 at 006, 013, 045, 083, 117 (Chemical Economics Handbook); PX1001 at 005 (Tronox investor presentation)).

15. The primary customers of TiO2 include paint and coatings manufacturers and plastic producers, which account for approximately 60% and 25% of the TiO2 consumed in North America, respectively. (PX9020 at 042 (Chemical Economics Handbook); PX3011 at 012 (Kronos Investor Presentation)). Paper and other specialty products, such as ink, food, cosmetics, and pharmaceuticals, use the remainder. (PX9020 at 042 (Chemical Economics Handbook); PX3011 at 012 (Kronos investor presentation)).

16. For nearly all customers, there are no commercially reasonable substitutes for TiO2. (PX9104 at 042 (Tronox 10-K); PX1000 at 006 (Tronox Presentation) (*in camera*); PX1073 at 117 (Bain Presentation to the Tronox Board) (*in camera*); PX7002 (Mouland, IHT at 38-40) (*in camera*); PX8002 at 001 (¶3) (Christian Decl.) (*in camera*); PX8006 at 001 (¶ 5) (Pschaidt Decl.) (*in camera*); PX8003 at 002 (¶¶ 6-7) (Young Decl.) (*in camera*); Vanderpool, Tr. 173-74; Malichky, Tr. 273-74).

17. TiO2 is produced from titanium-containing ores through one of two manufacturing processes that extract TiO2 from ore: (1) the chloride process that uses chlorine; and (2)

the sulfate process that uses sulfuric acid. (PX9020 at 021-23, 025-28 (Chemical Economics Handbook)). The chloride process is environmentally cleaner but technically more difficult to master and operate. (PX9020 at 027-30 (Chemical Economics Handbook)).

18. The chloride process generally produces higher quality TiO2 with a bluer tint, compared to a yellower tint for TiO2 manufactured from the sulfate process. (Vanderpool, Tr. 182-83; Malichky, Tr. 274-75; Young, Tr. 665 ({[redacted]}) (*in camera*); Pschaidt, Tr. 978 (*in camera*); PX7049 (Zamec, Dep. at 131-32) (*in camera*); PX1322 at 003 (Tronox Presentation) (*in camera*)). Chloride TiO2 is more durable than sulfate TiO2. (Malichky, Tr. at 274-75; PX1324 at 001 (Romano email to Casey) (*in camera*)).

19. The vast majority of TiO2 sold to and consumed by North American customers is chloride TiO2. (PX7000 (Snider, Dep. at 82-83) (*in camera*); PX8002 at 004 (¶17) (Christian Decl.) (*in camera*); Malichky, Tr. 294 (*in camera*)). {[redacted]} (PX5000 at 047-48 (¶101 & Figs. 17-18) (Hill Initial Report) (*in camera*)).

20. TiO2 can also have two different crystal structures—rutile and anatase. (PX9020 at 013 (Chemical Economics Handbook)). Rutile TiO2 and anatase TiO2 have different physical characteristics and applications and are not substitutes for any use relevant to this matter. (PX1424 at 010 (Tronox presentation) (*in camera*); PX9022 at 120 (Venator SEC Filing)).

21. In North America, customers purchase TiO2 either in a liquid slurry or in a bagged dry powder form. (PX9020 at 033 (Chemical Economics Handbook); Christian, Tr. 782). TiO2 slurry is made by dispersing TiO2 powder in water with other additives. (Christian, Tr. 782; Engle, Tr. 2451-52; PX7007 (Van Niekerk, Dep. at 44.) (*in camera*)). TiO2 slurry is then delivered to customers by rail cars or tank cars. (Malichky, Tr. 303 (*in camera*); Christian, Tr. 782; Pschaidt, Tr. 981 (*in camera*)). Slurry TiO2 can be pumped directly into customers' storage tanks, which simplifies handling and manufacturing. (PX9020 at 045 (Chemical Economic Handbook); Pschaidt, Tr. 982 (*in camera*); Engle, Tr. 2451-52).

22. TiO2 slurry demand is much higher in North America than in other regions. (Engle, Tr. 2535; PX8004 at 002 (¶ 7) (O'Sullivan Decl.) (*in camera*)). Large paint and coatings manufacturers in North America generally purchase [redacted] (PX7035 (Christian, Dep. at 202-03) (*in camera*); PX7025 (Malichky, Dep. at 112) (*in camera*); PX7027 (Pschaidt, Dep. at 33-34) (*in camera*); PX7007 (Van Niekerk, Dep. at 44) (*in camera*); PX9020 at 045 (Chemical Economic Handbook)). North American slurry TiO2 is [redacted] (Malichky, Tr. 310 (*in camera*); PX7016 (DeCastro, Dep. at 84) (*in camera*)).

III. MARKET DEFINITION

A. The Sale of Chloride TiO2 to Customers in North America Is a Relevant Market

23. Under the Horizontal Merger Guidelines, market definition serves two purposes: first, to identify a product in a particular geography in which a competitive concern may arise as a result of a transaction; and two, to define the markets so that competitors can be

identified and concentration measured. (PX9085 at 010 (Horizontal Merger Guidelines, § 4); Hill, Tr. 1667; PX5000 at 040 (¶ 86) (Hill Initial Report) (*in camera*)).

24. Market definition under the Horizontal Merger Guidelines "focuses solely on demand substitution factors," determining whether a hypothetical monopolist would find it profitable to raise the price of the product, or, in the alternative, if customers would substitute to other products in such large numbers that it would not be profitable for the hypothetical monopolist to raise the price of the product. (PX9085 at 010 (Horizontal Merger Guidelines, § 4); Hill, Tr. 1667-68; PX5000 at 040 (¶¶ 87-88) (Hill Initial Report) (*in camera*)).

25. Dr. Hill followed the Horizontal Merger Guidelines for his analysis of market definition in this case. (Hill, Tr. 1663-64). Using the hypothetical monopolist test prescribed by the Horizontal Merger Guidelines, Dr. Hill concluded that the sale of chloride TiO2 to customers in North America is the relevant market to assess the competitive effects of this transaction. (Hill, Tr. 1734; PX5000 at 040 (¶ 89) (Hill Initial Report) (*in camera*); *see* CCFF Section III.A.iii., ¶¶ 323-29, below).

i. Chloride TiO2 Is a Relevant Product Market

26. The qualitative and quantitative evidence make it clear that chloride TiO2 is a relevant product market in which to assess this merger. (*See* CCFF ¶¶ 27-133, below).

27. North American customers and producers agree that sulfate TiO2 is not a close substitute for chloride TiO2. (*See* CCFF ¶¶ 31-45, below). North American customers demand chloride TiO2 for the vast majority of their products and purchase significantly higher amounts of chloride TiO2 as compared to sulfate TiO2. (*See* CCFF ¶¶ 46-57, below).

28. North American customers and suppliers agree that chloride TiO2 has distinct attributes required for customers' products and that limit the ability for customers to switch between chloride and sulfate TiO2. (*See* CCFF ¶¶ 58-92, below).

29. Because chloride TiO2 has distinct attributes, North American customers cannot readily switch from chloride TiO2 to sulfate TiO2 without significant testing and significant costs associating with switching between the products. (*See* CCFF ¶¶ 93-110, below).

30. North American customers have not switched to sulfate TiO2 even with chloride TiO2 being consistently higher priced than sulfate TiO2. (*See* CCFF ¶¶ 111-33, below).

(a) Chloride TiO2 and sulfate TiO2 are not close substitutes for North American customers

31. North American market participants broadly agree that sulfate TiO2 is not a close substitute for chloride TiO2. (*See* CCFF ¶¶ 32-45, below). There are several reasons for this: (1) North American customers demand chloride TiO2 over sulfate TiO2 for most of their products; (2) chloride TiO2 offers a range of performance characteristics that sulfate TiO2 lacks; and (3) North American customers do not switch to sulfate TiO2 even when there is a significant and persistent price gap between chloride TiO2 and sulfate TiO2. (*See* CCFF ¶¶ 46-133, below).

32. Tronox and Cristal's own documents support the distinctions between chloride TiO2 and sulfate TiO2, demonstrating they are not close substitutes, and describe the limited threat posed by sulfate TiO2. (PX1427 at 003 (Jean-Jacques email to Casey) ({[redacted]}) (*in camera*); PX9015 at 011 (Q1 2013 Tronox earnings call) ("[E]ssentially there is not active, producing chloride pigment manufacturing facility in China today, certainly not in any scale. So we don't compete in

the traditional Chinese sulfate product anyway. We are selling to customers that have demand for our higher-quality chloride product, and that cannot be met by Chinese manufacturers at this point, because they don't have any."); PX2229 at 005 (Cristal email with attachment) ("Even the best performing Sulfate rutile requires 1.8X more pigment to equal the performance of Tiona 595 [a chloride TiO2 grade]" in film thickness for latex paint.)).

33. North American customers agree that chloride TiO2 is not a substitute for sulfate TiO2 because **{** [redacted] **}** (Vanderpool, Tr. 192-94 ({ [redacted] }) (*in camera*); Malichky, Tr. 274-77, 295-96 (partially *in camera*); Young, Tr. 642-44, 664-65, 670 (partially *in camera*); Christian, Tr. 781-82; PX7035 (Christian, Dep. at 119-20) (*in camera*); PX7044 (Vanderpool, Dep. at 87-91, 99-100) (*in camera*); *see* CCFF ¶¶ 34-39, below).

34. True Value described **{** [redacted] **}** and **{** [redacted] **}** (Vanderpool, Tr. 193-94 (**{** [redacted] **}**)(*in camera*)).

35. PPG, a coatings manufacturer, **{** [redacted] **}** (Malichky, Tr. 274, 295-96 (partially *in camera*); PX8000 at 004 (¶19) (Malichky Decl.) (**{** [redacted] **}**) (*in camera*)); PX8000 at 003 (¶15) (Malichky Decl.) (**{** [redacted] **}**) (partially *in camera*)).

36. For Sherwin-Williams, the largest paint producer in North America, **{** [redacted] **}** in its products sold in North America. (Young, Tr. 670 (*in camera*)).

37. In North America, Sherwin-Williams **{** [redacted] **}** (PX8003 at 003 (¶¶ 12-13) (Young Decl.) (partially *in camera*)). Sulfate TiO2 **{** [redacted] **}**" (PX8003 at 003 (¶12) (Young Decl.) (partially *in camera*)).

38. Specifically, **{** [redacted] **}** (PX7020 (Young, Dep. at 125-26) (*in camera*)).

39. Masco, maker of Behr paint, needs high quality chloride TiO2 to achieve one-coat hide, a feature of its paint line. (Pschaidt, Tr. 967; *see also* Christian, Tr. 776-77). **{** [redacted] **}** (PX8006 at 001, 004 (¶¶ 5, 20) (Pschaidt Decl.) (*in camera*)). Masco also needs to **{** [redacted] **}** (PX8006 at 002 (¶ 8) (Pschaidt Decl.) (*in camera*)).

40. TiO2 producers also agree that sulfate TiO2 and chloride TiO2 are not interchangeable in North America. (Christian, Tr. 781-82; PX7052 (O'Sullivan, Dep. at 117-18) (*in camera*); PX8002 at 002 (¶17) (Christian Decl.) (*in camera*); PX8005 at 002 (¶8) (Maiter Decl.); *see* CCFF ¶¶ 41-45, below).

41. Kronos, a TiO2 producer that sells both chloride TiO2 and sulfate TiO2 stated that North American customers have the lowest tolerance for sulfate TiO2 of any region in the world. (Christian, Tr. 781-82; PX8002 at 002 (¶7) (Christian, Decl.) (*in camera*)). **{** **}** (Christian, Tr. 813-14 (*in camera*); Christian, Tr. 778-79, 897 (North American customers, therefore, have an "overwhelming preference" for chloride TiO2 because it is needed to achieve the necessary product quality.).

42. According to Kronos, North America uses **{** **}** (PX7035 (Christian, Dep. at 219) (*in camera*)). **{** **}** (PX7035 (Christian, Dep. at 244-45) (*in camera*)).

43. Chemours views that in North America, **{** **}** which are 100% chloride TiO2. (PX8004 at 002-03 (¶ 9) (O'Sullivan Decl.) (**{** **}**) (*in camera*)).

44. **{** [redacted] **}** (PX7052 (O'Sullivan, Dep. at 145-47) (*in camera*)).

45. North American customers have **{** [redacted] **}** than many other regions. (PX8004 at 002 (¶ 7) (O'Sullivan Decl.) (**{** [redacted] **}**) (*in camera*)).

(1) North American customers demand chloride TiO2 over sulfate TiO2 for most of their products

46. TiO2 producers and customers all recognize that significantly more chloride TiO2 is purchased in North America as compared to sulfate TiO2. (PX9012 at 008 (Q4 2014 Tronox earnings call) (Tronox recognizes that chloride TiO2 dominates the North American market, making up "95% or 98% or some very, very high number."); PX1322 at 003 (Tronox presentation) (*in camera*); PX7000 (Snider, Dep. at 82-83) (**{** [redacted] **}**) (*in camera*)). The disproportionate amount of chloride TiO2 purchased in North America is due to customer demand. (PX8002 at 004 (¶ 17) (Christian Decl.) (*in camera*) (**{** [redacted] **}**); PX7003 (DeCastro, IHT at 21) (RPM notes that **{** [redacted] **}**) (*in camera*)). Using data from customers and producers, Dr. Hill's analysis indicates that **{** [redacted] **}** (PX5000 at 047 (¶101) (Hill Initial Report) (*in camera*)).

47. End use customers in the United States and Canada demand **{** [redacted] **}** (Malichky, Tr. 294-95 (*in camera*); PX8005

at 002 (¶ 8) (Maiter Decl.)). This causes direct customers to purchase chloride TiO2 to ensure that they have the high quality products with the necessary attributes that their customers want. (Vanderpool, Tr. 183, 185 ("I can tell you that [in all our lines] chloride [TiO2] is what we use primarily, 90, 95 percent."); PX7044 (Vanderpool, Dep. at 87-91, 99-100) (*in camera*); Young, Tr. 643, 657 (Sherwin-Williams "use[s] predominantly chloride TiO2 in North America" – accounting for **{** **}**) (partially *in camera*); Pschaidt, Tr. 985 (**{** **}**) (*in camera*); PX7035 (Christian, Dep. at 120) (*in camera*)).

48. Some North American customers purchase **{** **}** (Arrowood, Tr. 1065; PX7040 (Santoro, Dep. at 85) (*in camera*) (**{** **}**); PX7049 (Zamec, Dep. at 49) (**{** **}**) (*in camera*); PX8001 at 002 (¶ 13) (Zamec Decl.) (*in camera*)). The commodities manager at Deceuninck North America, a vinyl manufacturer, testified that for at least the past 32 years, his tenure at the company, it has never purchased sulfate TiO2 because of its need for chloride TiO2's superior "purity and quality." (Arrowood, Tr. 1065-66).

49. Customers in North America would not substitute sulfate TiO2 in place of chloride TiO2 in the majority of their products. (Arrowood, Tr. 1093-94; PX8006 at 001-02, 004 (¶¶ 5, 8, 20) (Pschaidt Decl.) (*in camera*); PX7044 (Vanderpool, Dep. at 87-91, 99-100) (*in camera*)).

50. For instance, "the only way that Deceuninck [North America] would even consider sulfate TiO2 would be if chloride TiO2 was unavailable." (Arrowood, Tr. 1093). In other words, certain customers like Deceuninck North America would consider sulfate TiO2 only as a last resort, to avoid shutting down their factories, when chloride TiO2 becomes totally unavailable to them. (Arrowood, Tr. 1093-94; PX7049 (Zamec, Dep. at 49-50) ({ }) (*in camera*); PX7000 (Snider, Dep. at 129-30) (*in camera*)).

51. Similarly, for North American coatings companies like Sherwin-Williams, { } (PX8003 at 003 (¶ 12) (Young Decl.) (partially *in camera*); PX7020 (Young, Dep. at 133-134) (*in camera*); Young, Tr. 642-43 (testifying that sulfate TiO2 is unsuitable for Sherwin-Williams' products in North America because it does not result in consistent brightness of color or consistent whites, and that it has been "unwilling to compromise the quality of [its] goods" by using sulfate TiO2)). Sherwin-Williams further explained that in other regions of the world, where quality standards are different than in North America, sulfate TiO2 has been suitable for use in its products. (Young, Tr. 642-43).

52. As Mr. Young testified, Sherwin-Williams has found that { } (Young, Tr. 665-66 (*in camera*)). Sherwin-Williams { } (PX8003 at 003 (¶¶ 12-14) (Young Decl.) (partially *in camera*); Young, Tr. 658-59 (*in camera*)).

53. For Masco, **{** [redacted] **}** (PX8006 at 001-02, 004 (¶¶ 5, 8, 20) (Pschaidt Decl.) (*in camera*)). **{** [redacted] **}** (Pschaidt, Tr. 978 (*in camera*)).

54. **{“** [redacted] **}** (PX8006 at 002 (¶8) (Pschaidt Decl.) (*in camera*); PX7027 (Pschaidt, Dep. at 112-13) (partially *in camera*); Pschaidt, Tr. 983-84 (*in camera*)).

55. **{** [redacted] **}** (Vanderpool, Tr. 192-93, 203-04 (*in camera*); Malichky, Tr. 298-99, 302-03 (*in camera*); Young, Tr. 658-59).

56. True Value can **{** [redacted] **}** (Vanderpool, Tr. 192, 203-04 (*in camera*)). **{** [redacted] **}** (Vanderpool, Tr. 192-93 (*in camera*)).

57. PPG can **{** [redacted] **}** (Malichky, Tr. 298-99, 302 (*in camera*); PX8000 at 003-04 (¶16) (Malichky Decl.) (*in camera*)). **{** [redacted] **}** (Malichky, Tr. 302-03 (*in camera*)). **{** [redacted]

[redacted] (Malichky, Tr. 298 (*in camera*)).

(2) North American customers and producers agree that chloride TiO2 has superior performance characteristics and other advantages that sulfate TiO2 lacks

58. Producers and customers agree that chloride TiO2 is higher quality and has performance characteristics that sulfate TiO2 does not have, limiting the substitutability between the two products for North American customers. (*See* CCFF ¶¶ 59-66, below). These characteristics include opacity, brightness, durability, scrubbability, and tone that require North American TiO2 customers to use chloride TiO2 in high-quality applications. (*See* CCFF ¶¶ 67-92, below).

59. Tronox's own documents state that chloride TiO2 is higher quality, offers a wide range of advantages over sulfate TiO2 in North America and that Tronox does not believe substitution between them in North America is likely. A 2015 Tronox presentation lists three reasons [redacted] (PX1322 at 002 (Tronox Investor Presentation) ([redacted]

[redacted]**}**) (*in camera*); PX1346 at 013 (Tronox presentation) (*in camera*); PX1427 at 003 (Jean-Jacques email to Casey) (*in camera*); Van Niekerk, Tr. 3996).

60. **{**[redacted]**}** (Christian, Tr. 960; PX8004 at 002-03 (¶ 9) (O'Sullivan Decl.) (*in camera*)).

61. Specifically, Kronos notes that **{**[redacted]**}** (PX8002 at 004 (¶¶ 17-18) (Christian Decl.) (*in camera*)). Kronos also notes that {[redacted]**}** (PX3038 at 022 ({[redacted]**}**) (*in camera*)).

62. Customers view chloride TiO2 as being higher quality than sulfate TiO2, and necessary for many of their applications. (Arrowood, Tr. 1065; PX7016 (DeCastro, Dep. at 96-97) ({[redacted]**}**) (*in camera*); PX7044 (Vanderpool, Dep. at 87-91) (*in camera*)).

63. For example, **{**[redacted]**}** **(**PX8003 at 003 (¶12) (Young Decl.) (partially *in camera*)).

64. Masco explained that {[redacted]} (PX8006 at 001 (¶5) (Pschaidt Decl.) (*in camera*)).

65. North American customers require the use of chloride TiO2 because of its superior attributes including brightness, durability, opacity and scrubbability. (*See* CCFF ¶¶ 67-92, below).

66. For example, chloride TiO2 is {[redacted]} (PX7003 (DeCastro, IHT at 21) (RPM reports that {[redacted]}) (*in camera*); PX8000 at 003-04 (¶¶ 15, 19) (Malichky Decl.) (partially *in camera*); PX7025 (Malichky, Dep. at 122-23) (PPG {[redacted]}) (*in camera*); Young, Tr. 666 (Sherwin-Williams explained that {[redacted]}) (*in camera*); PX8005 at 002 (¶7) (Maiter Decl.)).

Brightness

67. Chloride TiO2 is brighter in appearance, which is required by North American customers. (Vanderpool, Tr. 182-83 (chloride TiO2 is "purer" than sulfate TiO2, which is "dirtier" and has a yellow tint); Young, Tr. 643; Christian, Tr. 778-80, 897 ("overwhelming preference" for chloride TiO2 in North America); PX8002 at 004 (¶17) (Christian Decl.) (*in camera*); PX7027 (Pschaidt, Dep. at 54-55) (*in camera*)).

68. This brighter appearance is due to chloride TiO2's bluer undertone compared to sulfate TiO2's yellow undertone. (Vanderpool, Tr. 182-83; Malichky, Tr. 274-75; Young, Tr.

665 (*in camera*); Pschaidt, Tr. 978 (*in camera*); PX7049 (Zamec, Dep. at 131-32) (*in camera*); PX1322 at 003 (Tronox presentation) (*in camera*)). Customers also describe **{** **}** (PX7003 (DeCastro, IHT at 21) (*in camera*)).

69. Brighter colors and brilliant whites are achievable only through chloride TiO2. (PX7052 (O'Sullivan, Dep. at 160-61) (*in camera*); PX9121 at 006 (Chemours 2017 Form 10-K)). As Mr. O'Sullivan of Chemours testified, **{** **}** (PX7052 (O'Sullivan, Dep. at 160-61 (*in camera*)).

70. For North American customers, sulfate TiO2 **{** **}** (Young, Tr. 665 (**{** **}**) (*in camera*); Pschaidt, Tr. 978 ({ **}**) (*in camera*); PX8003 at 003 (¶ 12) (Young Decl.) (partially *in camera*); PX7040 (Santoro, Dep. at 26-27) (*in camera*)).

71. Sherwin-Williams determined **{** **}** (PX8003 at 003 (¶ 12) (Young Decl.) (partially *in camera*)).

72. Masco "pride[s] [itself] [on] hav[ing] the ultra pure white feature with [its] Behr brand. This delivers some crisp colors, especially in the white pigmented paints, but also the majority of the paint that is tinted at the store level . . . ." (Pschaidt, Tr. 971). Thus, the ultra pure white feature is "[e]xtremely important" to Behr paints. (Pschaidt, Tr. 972). The ultra pure white feature is created by "the TiO2 that [Masco] use[s], and in order to

achieve that [Masco] need[s] to use TiO2 produced based on the chloride process." (Pschaidt, Tr. 973; Pschaidt, Tr. 977 ({ }) (*in camera*); PX8006 at 002, 004 (¶¶ 8, 20) (Pschaidt, Decl.) (*in camera*)).

73. Tronox's own ordinary course documents, dating as far back as 2012, recognize that { } (PX1322 at 002 (Tronox presentation) ({ }) (*in camera*); PX1346 at 013 (Tronox Investor Presentation) ("Chloride technology yields consistently whiter, brighter pigment grades preferred for many of the largest end-use applications (e.g. paints and plastics) as compared to the sulfate process."); PX1324 at 001 (Romano email to Casey) ( ) (*in camera*)).

74. Other TiO2 producers recognize that { } (Christian, Tr. 773-74 ("[T]he most noteworthy is going to be in the general color and undertone of the product produced. An SP [sulfate TiO2] product is going to produce what we would call a yellowish undertone, where the CP [chloride TiO2] product is going to have a brighter white to it, or we call it a bluish undertone."); PX8002 at 004 (¶ 17) (Christian Decl.) ({ }

[redacted]

[redacted]

[redacted]**}**) (*in camera*); PX8004 at 002 (¶ 7) (O'Sullivan Decl.) ([redacted]**}**) (*in camera*); PX8005 at 002 (¶7-8) (Maiter Decl.)).

Durability

75. In addition to brightness, chloride TiO2 is more durable than sulfate TiO2, which is a requirement for North American customers (Christian, Tr. 777; Vanderpool, Tr. 193, 195 (*in camera*); PX8005 at 002 (¶ 7) (Maiter Decl.)). The chemistry of the sulfate TiO2 is the reason it is less durable than chloride TiO2. (Malichky, Tr. 274-75 ("The other main difference is in the durability, so sulfate carries iron with the product, and that decreases the durability in our final application."); Young, Tr. 666-67 ([redacted]

[redacted]**}**) (*in camera*); PX8003 at 003 (¶12) (Young Decl.) ("[T]he chemistry of sulfate TIO2 may result in . . . less durability than chloride TiO2.")).

76. Customers that need durability cannot substitute chloride TiO2 for sulfate TiO2. (CCFF ¶¶ 77-80, below).

77. For PPG, [redacted]

[redacted]**}** (Malichky Tr. 294-95 ([redacted]

[redacted]

[redacted]

[redacted]

[redacted]**}**) (*in camera*); PX8000 at 003-04 (¶¶ 15, 19) (Malichky Decl.) (*in camera*)).

78. In laboratory testing, **{**[redacted]**}** (Vanderpool, Tr. 195 (*in camera*)).

79. RPM, a coatings manufacturer of the Rust-Oleum brand, **{**[redacted]} (PX7003 (DeCastro, IHT at 21) (*in camera*)).

80. Mississippi Polymers also agrees that **{**[redacted]} (PX7049 (Zamec, Dep. at 131-32) (*in camera*)).

81. Other TiO2 producers agree that chloride TiO2 has better durability than sulfate TiO2. (*See* CCFF ¶¶ 82-84, below).

82. Kronos, a TiO2 producer that sells both chloride TiO2 and sulfate TiO2, testified that **{**[redacted]**}** (Christian, Tr. 777; PX8002 at 004 (¶ 17) (Christian Decl.) (*in camera*)).

83. Venator, another TiO2 producer that sells both chloride and sulfate TiO2, recognizes that chloride TiO2 has superior durability to sulfate TiO2. (PX8005 at 002 (¶ 7) (Maiter Decl.)).

84. Chemours explained that **{** [redacted] **}** (PX7052 (O'Sullivan, Dep. at 161) (*in camera*)).

Other attributes of chloride TiO2

85. Customers and TiO2 producers agree that chloride TiO2 also has other properties that are superior to sulfate TiO2, such as opacity, coverage, scrubbability, and tint strength. (*See* CCFF ¶¶ 86-92, below).

86. Sherwin-Williams recognizes that "the chemistry of sulfate TIO2 may result in less coverage" than chloride TiO2, making it less desirable for paint. (PX8003 at 003 (¶12) (Young Decl.)).

87. True Value explained that **{** [redacted] **}** (Vanderpool, Tr. 195 (*in camera*)).

88. PPG explained that **{** [redacted] **}** (Malichky, Tr. 296-97 (*in camera*); PX7025 (Malichky, Dep. at 117-18) (noting that **{** [redacted] **}**) (*in camera*); PX8000 at 004 (¶19) (Malichky Decl.) (*in camera*)).

89. Sherwin-Williams notes that **{** [redacted] **}** (PX8003 at 003 (¶ 12) (Young Decl.) (*in camera*)). Sherwin-Williams also explained that sulfate TiO2 is inferior to chloride TiO2 in terms of particle size distribution. (Young, Tr. 643).

90. Mississippi Polymers states that **{** [redacted] **}** (PX8001 at 002 (¶ 13) (Zamec Decl.) (*in camera*)).

91. RPM finds that **{** [redacted] **}** (PX7016 (DeCastro, Dep. at 97) (*in camera*)).

92. Kronos recognizes that chloride TiO2 has superior tint strength to sulfate TiO2 among other properties. (Christian, Tr. 777 ("Like I mentioned earlier, it's a superior product on its optical, you know properties, whether . . . its color undertone, or its tinting strength, durability, a whole host of different ways of evaluating a grade of TiO2, and chloride products tend to outperform sulfate products.")).

(b) North American customers cannot readily switch their formulation of products from chloride TiO2 to sulfate TiO2 due to high costs and testing time

93. North American customers cannot readily switch from chloride to sulfate TiO2 because of the significant costs, testing time, and risks to their products. (*See* CCFF ¶¶ 94-110, below). These issues include costs, time and risks associated with qualification, reformulation and need for point-of-sale tinting, which is only possible with chloride TiO2. (*See* CCFF ¶¶ 94-110, below).

94. TiO2 producers are aware of the difficulties that customers face in attempting to switch from using chloride TiO2 to sulfate TiO2. (PX1000 at 002, 005 (2016 Tronox strategy document) ({ [redacted] }) (*in camera*); Christian, Tr. 777 ("Q: Yes. So a customer -- in your experience, what would a customer need to do to reformulate a product from using chloride to sulfate? A: I don't have a lot

of examples of that happening. That would be pretty rare, but it would entail a significant amount of work, a lot of trials, a complete reformulation of their product and grade . . . .")).

95. It costs customers **{** [redacted] **}** (PX8002 at 004-05 (¶ 20) (Christian Decl.) (*in camera*); PX3038 at 022 ({ [redacted] }) ({ [redacted] }) (*in camera*); Christian, Tr. 777-78; Young, Tr. 652-54 ("Q: How long does it take for Sherwin Williams to qualify a grade of TiO2? A: It can vary, but typically it can be as much as three years."); Pschaidt, Tr. 989-90 (*in camera*)).

96. As PPG explained, **{** [redacted] **}** (PX8000 at 004 (¶ 19) (Malichky Decl.) (*in camera*); Malichky, Tr. 301 (*in camera*)).

97. Reformulation involves { [redacted] **}** (Malichky, Tr. 301 (*in camera*); Christian, Tr. 777-78).

98. { [redacted] **}**" than substituting a chloride TiO2 with another chloride TiO2.

(PX7044 (Vanderpool, Dep. at 128) (*in camera*); PX8002 at 004-05 (¶ 20) (Christian Decl.) (*in camera*)).

99. Reformulation from chloride TiO2 to sulfate TiO2 also {[redacted]} (Malichky, Tr. 301-02 (*in camera*); PX8002 at 004-05 (¶20) (Christian, Decl.) ({[redacted]}) (*in camera*)).

100. Reformulation can take {[redacted]} (Young, Tr. 660-61 (It took Sherwin-Williams {[redacted]}) (*in camera*); PX8003 at 004 (¶¶ 17-20) (Young Decl.) (partially *in camera*); Vanderpool, Tr. 186; PX8001 at 002 (¶ 10) (Zamec Decl.) (*in camera*); PX8006 at 002 (¶11) (Pschaidt Decl.) (*in camera*)).

101. Reformulation can also take {[redacted]} For example, Kronos estimates that {[redacted]} to qualify a new TiO2 grade. (PX7035 (Christian, Dep. at 215-16) (*in camera*)).

102. For coatings manufacturers, qualifying a new grade of TiO2 is a multi-step process including tests on outdoor weathering and subjective feedback from customers, and can take as long as {[redacted]} (Young, Tr. 652-54; Pschaidt, Tr. 989-90 ({[redacted]}

[redacted]

(*in camera*); PX8003 at 004 (¶ 17) (Young Decl.) ("It takes a minimum of one year to qualify a TiO2 grade for use in one of our core architectural or industrial coatings products, and it may take as long as three years."); PX8006 at 002 (¶11) (Pschaidt Decl.) ([redacted]) (*in camera*)). Outdoor testing is conducted [redacted] (Pschaidt, Tr. 990 (*in camera*)).

103. For industrial coatings, qualification has additional steps. Depending on the application, "some industrial coatings require customer or regulatory approval." (PX8003 at 004 (¶19) (Young Decl.)). In addition, the time needed for performance testing varies based on the industrial coating application. (PX8003 at 004 (¶19) (Young Decl.) ("Some industrial coatings, for instance, need to be tested in salt water for two years.")).

104. Plastics manufacturers, such as Deceuninck North America (DNA), explain that it takes three to six months to qualify a chloride TiO2 supplier. (Arrowood, Tr. 1067). However, for DNA to switch to a sulfate TiO2 grade, "it would require extensive testing" – "a lot of time, a lot of money, a lot of effort" and could take two years or longer. (Arrowood, Tr. 1088). Compared to qualifying a chloride TiO2 grade, it could take four times longer to qualify a sulfate TiO2 grade. (Arrowood, Tr. 1067, 1088).

105. Another reason North American customers cannot readily substitute sulfate TiO2 for chloride TiO2 is point-of-sale tinting and color matching. (*See* CCFF ¶¶ 106-10, below).

Point-of-sale tinting, which is common in North America, is where a customer picks a color at the retailer or store and the can of paint is customized to the customer's request. (Young, Tr. 643-44 (Tinting is "a process by which colorant is usually injected into a can of paint, its put on a shaker and it achieves the color that a customer desires, so it's basically customizing the product"); PX7020 (Young, Dep. at 48); Pschaidt, Tr. 971-72 (explaining tint system for Masco's Behr paints and noting that the majority of paints Masco sells are tinted in-store)).

106. Internationally, coloring is typically predetermined at manufacturing, so instead of customized paint there are "packaged colors that are standard offerings [] so colors are predetermined, and you can buy it off the shelf." (Young, Tr. 644-45; PX7020 (Young, Dep. at 48, 134) ("Typically in Europe colors are premade in the manufacturing environment so you have the ability to overcome variation in color by adjusting in the plant. In the North America[n] market, all the paint companies tint at point of sale . . . ." "It's a lot of prepackaged colors in South America."); Malichky, Tr. 302-03 ({[redacted]}) (*in camera*)).

107. Sherwin-Williams can use sulfate TiO2 for its paints in Europe but not in North America, because unlike Europe, in North America paint is tinted at the point of sale. This requires chloride TiO2 in order to get the color consistency and bright white that customers expect. (PX7020 (Young, Dep. at 47-49)).

108. A key consequence of point-of-sale tinting is that customers require consistency in TiO2 used in the system, which demands chloride TiO2 because sulfate cannot provide the same consistent results as chloride TiO2. (PX1322 at 003 (Tronox presentation) ({[redacted]

[redacted]) (*in camera*); PX7020 (Young, Dep. at 47-49) (Point-of-sale tinting requires chloride TiO2 in order "to achieve the color palette reliably that the customers expect, it has to be a bright white, a clean white product"); Young, Tr. 643-47; PX7025 (Malichky, Dep. at 117-18) ([redacted]) (*in camera*).

109. Customers testified that [redacted] making it less likely that they will be willing to switch to a different TiO2 product. (Malichky, Tr. 296-97 ([redacted]) (*in camera*); Vanderpool, Tr. 196 ([redacted]) (*in camera*)).

110. [redacted] (Malichky, Tr. 296-97 (*in camera*); PX7025 (Malichky, Dep. at 124) (*in camera*)). It is also a challenge for applications such as [redacted] (Malichky, Tr. 297 (*in camera*)).

(c) North American customers overwhelmingly purchase chloride TiO2 even when it becomes significantly more expensive than sulfate TiO2

111. For the last several years, chloride TiO2 has consistently been more expensive than sulfate TiO2, yet North American customers have continued to purchase chloride TiO2 notwithstanding the significant price premium for chloride TiO2 over sulfate TiO2. (*See* CCFF ¶¶ 112-33, below).

112. Between 2012 and 2017, chloride TiO2 had a higher price than sulfate TiO2 in North America. (Young, Tr. 647-48). During this time, the price in North America for chloride TiO2 has been as much as 40% higher than for sulfate TiO2. (Young, Tr. 647-48).

113. Cristal's own executives and documents admit that **{** **}** (PX7043 (Gigou, Dep. at 23) (**{** **}**) (*in camera*); PX2366 at 003 (Cristal spreadsheet for Q4 2017) (**{** **}**) (*in camera*); PX2369 at 004 (Cristal spreadsheet for Q1 2018) (**{** **}**) (*in camera*)).

114. Tronox's sales executive admits that the sales teams are instructed to **{** **}** (PX1431 at 001 (Duvekot email) (**{** **}**) (*in camera*); Duvekot, Tr. 1295-98 (*in camera*); PX7026 (Duvekot, Dep. at 64-65) (**{** **}**) (*in camera*)).

115. **{** **}** (PX7026 (Duvekot, Dep. at 64-65) (**{**

[redacted]

[redacted]}) (*in camera*)).

116. {[redacted]

[redacted]} (Vanderpool, Tr. 197-98 ({[redacted]

[redacted]}) (*in camera*); PX7044 (Vanderpool, Dep. at 109-10) (*in camera*); PX7026 (Duvekot, Dep. at 67-68) (*in camera*); Duvekot Tr. 1296-98 (*in camera*); *see also* Young, Tr. 670 ({[redacted]

[redacted]}) (*in camera*)).

117. Analyzing data from customers and producers, Dr. Hill determined that {[redacted]

[redacted]} (Hill, Tr. 1683-85; PX5000 at 046-47 (¶¶ 100-02 & Figs. 17-18) (Hill Initial Report) (*in camera*)). {[redacted]

[redacted]} (Hill, Tr. 1683-85; PX5000 at 046-47 (¶100 & Fig. 17) (Hill Initial Report) ({[redacted]

[redacted]}) (*in camera*)). {[redacted]

[redacted]

[redacted] **}** (PX5000 at 046 (¶102 & Fig. 18) (Hill Initial Report) (*in camera*); Hill, Tr. 1684-85).

118. Based on quantitative and qualitative evidence, Dr. Hill concluded that **{** [redacted] **}** (PX5000 at 046 (¶100) (Hill Initial Report) (*in camera*); Hill, Tr. 1683-85).

119. Tronox's own statements affirm Dr. Hill's analysis as Tronox noted to investors that North American customers purchase chloride TiO2 regardless of price. (Hill, Tr. 1688-89; PX9012 at 008 (Q4 2014 Tronox earnings call) ("In various markets, the[]customers have responded to what happened on pricing a year ago in[]different ways. For example in the North American market, it was 95% or 98%, or some[]very, very high number chloride[.] [I]t remains, essentially the same[]number market share for chloride. That was true when prices were over[]$4,000 a ton, it is true now [when chloride prices are lower]."); PX9119 at 009 (Tronox investor call transcript) (stating that major North American TiO2 customers' "ability to substitute sulfate for chloride . . . is limited by their need to maintain the quality levels of their own products.")).

120. Further, Tronox's prepared statement to investors noted that **{** [redacted] **}** (PX1399 at 004-05 (Sept. 2013 "Fireside chat" Q&A with Tronox CEO) ([redacted]

[redacted]**}**) (*in camera*)).

121. Cristal's sales executive for North America admits that **{**[redacted]**}** (PX7037 (Pickett, Dep. at 123-24) (*in camera*)).

122. Kronos, a TiO2 competitor, also observed that **{**[redacted]**}** (Christian, Tr. 819-20, 22 (Kronos **{**[redacted]**}** during the shortages) (*in camera*); PX7035 (Christian, Dep. at 138, 160-61) (*in camera*)). Kronos does not **{**[redacted]**}** (PX3038 at 022 (**{**[redacted]**}**) (*in camera*)).

123. Customers have not switched to sulfate TiO2 even with chloride TiO2 being consistently higher priced than sulfate TiO2. (*See* CCFF ¶¶ 124-31, below).

124. As True Value's Mr. Vanderpool testified: **{**[redacted]

[redacted] **}** (Vanderpool, Tr. 197 (*in camera*)).

125. In fact, Mr. Vanderpool of True Value is unaware of any instance, regardless of price, in which True Value switched from using a grade of chloride TiO2 to a grade of sulfate TiO2. (Vanderpool, Tr. 187).

126. Sherwin-Williams **{** [redacted] **}** (Young, Tr. 668-70 (*in camera*); PX8003 (Young Decl. ¶¶ 12-13) (partially *in camera*)).

127. Even when sulfate TiO2 was **{** [redacted] **}** chloride TiO2, Sherwin Williams **{** [redacted] **}** (Young, Tr. 669-70 (*in camera*); PX7020 (Young, Dep. at 131) (*in camera*); PX8003 at 003 (¶¶ 12-13) (Young Decl.) (partially *in camera*)).

128. Sherwin-Williams continually purchased higher priced chloride TiO2 "[i]n order to consistently meet our customers' requirements for quality and performance." (Young, Tr. 648). **{** [redacted] **}** (Young, Tr. 669-70 (*in camera*)).

129. PPG **{** [redacted] **}** (PX7025 (Malichky Dep. at 117-19) (*in camera*)).

130. Masco **{** [redacted] **}** (Pschaidt, Tr. 979-80 ({ [redacted] }) (*in camera*)). Masco was **{** [redacted] **}** (Pschaidt, Tr. 979, 981 (*in camera*); PX8006 at 001 (¶ 6) (Pschaidt Decl.) (*in camera*)).

131. Deceuninck North America testified that it did not consider shifting its TiO2 purchases from chloride TiO2 to sulfate TiO2 when the price of chloride TiO2 was very high. (Arrowood, Tr. 1088).

132. **{** [redacted] **}** if the price of chloride TiO2 went up compared to sulfate TiO2. (Young, Tr. 669 (*in camera*); Vanderpool, Tr. 197, 203-04 (True Value has **{** [redacted] **}**) (*in camera*); Arrowood, Tr. 1093; PX8006 at 002 (¶ 6) (Pschaidt Decl.) (*in camera*)).

133. Deceuninck North America explained that Tronox has issued five price increases in the past two years, each one being about three to five percent. (Arrowood, Tr. 1092-93). In response to these price increases, Deceuninck North America has not changed its supplier

of chloride TiO2 from Tronox nor has it considered switching to purchasing any sulfate TiO2. (Arrowood, Tr. 1093 ("Just -- on the sulfate TiO2, just to be, you know, very candid, the only way that Deceuninck would even consider sulfate TiO2 would be if chloride TiO2 was unavailable.")).

ii. Sales to Customers in the United States and Canada ("North America") Is a Relevant Geographic Market

134. The Horizontal Merger Guidelines provide a framework for defining the relevant geographic market. (PX9085 at 016 (Horizontal Merger Guidelines, § 4.2)). For purposes of calculating market shares and analyzing competitive effects for chloride TiO2, the appropriate way to analyze the relevant geographic market is based on the location of customers. (PX9085 at 017 (Horizontal Merger Guidelines, § 4.2.2)).

135. Defining the geographic market by customer location is appropriate because (1) TiO2 producers are able to price discriminate by region; and (2) the ability to arbitrage is limited. (PX9085 at 017 (Horizontal Merger Guidelines, § 4.2.2)).

136. Arbitrage occurs when customers take advantage of price differences across markets by buying a product—here, chloride TiO2—in a low-priced region and being responsible for arranging transportation, duties, shipping and logistics costs etc. to move the product themselves to the high-priced location where the chloride TiO2 will be used. (PX9085 at 009-10, 017 (Horizontal Merger Guidelines, §§ 3 & 4.2.2); Hill, Tr. 1714-15; Duvekot, Tr. 1303-05 (*in camera*)).

137. The Merger Guidelines state, "The scope of geographic markets often depends on transportation costs," as well as other factors such as tariffs, reputation, and service availability, among others. (PX9085 at 016 (Horizontal Merger Guidelines, § 4.2)).

138. Chloride TiO2 is delivered to customer locations, and is **{** [redacted] **}** (*See* CCFF ¶¶ 165-71, below).

139. After reviewing qualitative and quantitative information and conducting economic analysis consistent with the Horizontal Merger Guidelines, Dr. Hill concluded that the geographic market based on locations of customers is the right framework because chloride TiO2 producers are engaging in geographic price discrimination. (Hill, Tr. 1714). Dr. Hill's conclusion is based on the fact that producers know the location of their customers, thus can price discriminate, and that for customers, arbitrage is not a commercially feasible means of avoiding a price increase. (Hill, Tr. 1714-15).

140. Customers and suppliers consistently testified that the cost of transportation and duties, which typically **{** [redacted] **}** as well as the extra logistical burdens for the customer, render arbitrage **{** [redacted] **}** for North American chloride TiO2 customers. (*See* CCFF ¶¶ 259-300, below).

141. Dr. Hill concluded, after reviewing documents, testimony, and performing an economic analysis, that North America is a relevant geographic market in which to assess the effects of the proposed acquisition. (Hill, Tr. 1713; *see* CCFF ¶¶ 160-64, below). This geographic market includes all sales of chloride TiO2 in North America, regardless of country of origin or supplier and, by definition, includes the **{** [redacted] **}** of North America TiO2 sales that consist of chloride TiO2 imported from abroad. (Hill, Tr. 1725-26; PX7056 (Hill, Dep. at 240) (*in camera*); PX5000 at 032 (¶ 78) (Hill Initial Report) (*in*

camera)). Moreover, rutile TiO2 imports comprise about {[redacted]} of the North American rutile TiO2 consumption. (PX5000 at 032 (¶ 78 n.130) (Hill Initial Report) (*in camera*)).

142. Based on an economic analysis consistent with the Horizontal Merger Guidelines, including the Hypothetical Monopolist Test and analysis of the qualitative information in the record from suppliers and customers, Dr. Hill concluded that a SSNIP by a hypothetical monopolist controlling all sales of chloride TiO2 to North American customers would not be defeated by those customers turning outside of North America to purchase chloride TiO2. (Hill, Tr. 1713-15, 1725-26, 1734; PX5000 at 060, 066-067 (¶¶ 136, 149-51) (Hill Initial Report) (*in camera*)).

143. Consistent with Dr. Hill's economic analysis, testimony and documents from Tronox and Cristal, competitors and customers confirm that North America is the relevant geographic market for the sales of chloride TiO2. (*See* CCFF ¶¶ 165-98, 226-31, below).

144. Due to differences in pricing and other demand characteristics that are described below between Mexico compared to the United States and Canada, North America is appropriately defined here to only include sales of chloride TiO2 to customers in the United States and Canada. (Hill, Tr. 1713; *see, e.g.*, PX2088 at 002 (Cristal email) ({[redacted]}) (*in camera*); CCFF ¶¶ 145-47, below).

145. Mexico is not included in the North American market for this matter because demand in Mexico is different from demand in the United States and Canada. (Hill, Tr. 1713 ("Market definition is about demand substitution, so it's appropriate to group together consumers who have similar demand. My review of the evidence caused me to conclude

that demand in the U.S. and Canada is similar and that Mexico is a different region. It has different demand."); PX5000 at 024-25 (¶¶ 56-58) (Hill Initial Report) (*in camera*)).

146. For example, seasonality of demand for architectural paints, for which TiO2 is a main ingredient, varies by geographic region. (PX7025 (Malichky, Dep. at 257-58) ({ }) (*in camera*)). In fact, seasonal demand for TiO2 varies by geographic region { }. (PX7050 (Mei, Dep. at 137-38) (*in camera*)).

147. Moreover, TiO2 producers, . (PX1327 at 005, 025 (Tronox LATAM 2015-2017 Strategy) ({ }) (*in camera*); PX7000 (Snider, IHT at 24) ({ }) (*in camera*); PX8004 at 002 (¶ 7) (O'Sullivan Decl.) (*in camera*); PX8005 at 002 (¶ 8) (Maiter Decl.)).

(a) Suppliers price-discriminate based on customer location by region

148. North American chloride TiO2 producers—Tronox, Cristal, Chemours, Kronos, and Venator—{ }. (PX8002 at 003 (¶ 13) (Christian Decl.) (*in camera*); PX8004 at 002 (¶ 7) (O'Sullivan Decl.) (*in camera*)).

149. As a result, chloride TiO2 producers set different prices to customers in North America compared to other regions. (*See* CCFF ¶¶ 172-98, below).

150. Company executives from Tronox and Cristal repeatedly confirmed, in testimony in investigational hearings, depositions, and at trial, the **{** **}** (*See* CCFF ¶¶ 151-59, below).

151. For example, as Tronox's Mr. Mouland, vice president of sales, testified, **{** **}**. (Mouland, Tr. 1172 (*in camera*)). **{** **}**. (Mouland, Tr. 1255 (*in camera*); *see also* Mouland, Tr. 1281 (**{** **}**) (*in camera*)). In a 2015 email, Mr. Mouland wrote: **{** **}** (PX1345 at 004 (Mouland email to Duvekot) (*in camera*)).

152. Likewise, as Tronox's Mr. Duvekot, another vice president of sales, testified, **{** **}** and that **{** **}**. (Duvekot, Tr. 1298-99 (*in camera*); PX1454 at 001 (Duvekot email to Mouland) (*in camera*); PX1451 at 001 (Duvekot email to Bradley) (**{** **}**) (*in camera*)).

153. This means that {[redacted]}. (Duvekot, Tr. 1302 ({[redacted]}) (*in camera*)).

154. According to Mr. Romano, Tronox's Chief Commercial Officer, {[redacted]} (PX7001 (Romano, IHT at 123-24) ({[redacted]}) (*in camera*); Romano, Tr. 2151-52 (*in camera*)).

155. Likewise, as Mr. Gigou, Cristal's vice president of sales, testified, {[redacted]}. (PX7043 (Gigou, Dep. at 14-15) (*in camera*); PX7037 (Pickett, Dep. at 46) ({[redacted]}) (*in camera*)).

156. At Cristal, {[redacted]} (PX7000 (Snider, IHT at 24, 30-31) (*in camera*)).

157. According to Mr. Stoll, who was Cristal's vice president of commercial during 2010-13, different TiO2 market dynamics in different regions were "driven by supply and demand dynamics in those particular regions." (Stoll, Tr. 2094). The competitive dynamics in Latin America at a particular time might be different from the competitive dynamics in North America, "[b]ased on supply and demand or GDP in particular countries in those regions." (Stoll, Tr. 2094-95). Therefore, the market dynamics are "quite different" in emerging markets than "in mature markets like North America." (Stoll, Tr. 2095).

158. Similarly, as Mr. Stoll testified in a deposition taken during one of the price fixing litigations, when determining {[redacted]} (PX2245 at 058 (*In Re: Titanium Dioxide Antitrust Litigation*, Deposition Transcript of Mark Stoll) (*in camera*)).

159. {[redacted]} (PX2245 at 083 (*In Re: Titanium Dioxide Antitrust Litigation*, Deposition Transcript of Mark Stoll) (*in camera*)).

160. Finally, based on the documents and quantitative data, Dr. Hill concluded, "the appropriate framework is to define the geographic market around the location of the consumers because the qualitative evidence and the quantitative evidence show that the price discrimination -- geographic price discrimination exists in this industry. That means different prices are charged in different regions." (Hill, Tr. 1712-13).

161. Dr. Hill further explained that under the Horizontal Merger Guidelines, "two things must be correct for it to be possible to engage in geographic price discrimination." (Hill, Tr. 1714). First, producers must know the location of their customers and second, arbitrage—which Dr. Hill described as "customers buying in a low-priced region and moving [the product] to a high-price region by themselves"—must not be economically feasible to defeat geographic price discrimination. (Hill, Tr. 1714-15; *see* CCFF ¶¶ 259-300, below).

162. Dr. Hill concluded, based on his economic analysis of Tronox and Cristal data and documents, including emails with customers, that **{** [redacted] **}**. (Hill, Tr. 1714-15, 1717-18 (partially *in camera*)).

163. Dr. Hill also performed an economic quantitative analysis called a hedonic regression which controls for different factors that determine price, and again concluded that **{** [redacted] **}**. (Hill, Tr. 1723-24 (*in camera*)).

164. Thus, following Section 4.2.2 of the Horizontal Merger Guidelines, Dr. Hill defined the relevant geographic market around the location of customers in North America. (Hill, Tr. 1713-14).

(1) North American customers receive delivery of chloride TiO2 at their locations in North America, with delivered pricing

165. North American customers obtain nearly all of the TiO2 they consume **{** [redacted] **}** (Pschaidt, Tr. 980 (*in camera*); Malichky, Tr. 304-05 (*in camera*); PX8003 at 002-03 (¶¶ 9-10) (Young Decl.) (*in camera*); PX7034 (Septien, Dep. at 68-69) (*in camera*); PX7040 (Santoro, Dep. at 12) (*in camera*)).

166. For example, **{** [redacted] **}** (Malichky, Tr. 304-05 (*in camera*); PX7025 (Malichky, Dep. at 69-70, 208-09) (*in camera*)).

167. Likewise, **{** [redacted] **}** (Pschaidt, Tr. 980 (*in camera*)).

168. **{** [redacted] **}**. (PX7016 (DeCastro, Dep. at 87-88) (*in camera*)).

169. **{** [redacted] **}** (PX7040 (Santoro, Dep. at 12) (*in camera*)).

170. According BASF, a multinational coatings manufacturer, **{** [redacted] **}** (PX7031 (Shah, Dep. at 35) ({ [redacted] }) (*in camera*)).

171. TiO2 suppliers also confirmed that nearly all of the TiO2 they sell to customers in North America is delivered to the customers' locations and sold on a delivered pricing basis. (PX7015 (Maiter, Dep. at 176)).

(2) Customers negotiate and purchase chloride TiO2 separately for each geographic region and pay different prices in each region

172. When purchasing chloride TiO2, customers with manufacturing facilities in multiple regions testified that **{** [redacted] **}** (*See* CCFF ¶¶ 173-98, below).

173. **{** [redacted] **}** (PX8003 at 006 (¶¶ 27-28) (Young Decl.) (*in camera*); *see* CCFF ¶¶ 192, 198, below).

174. As customers testified, **{** [redacted] **}** (Young, Tr. 672 (*in camera*); PX8003 at 006 (¶ 28) (Young Decl.) (*in camera*)).

175. For example, **{** [redacted] **}** (Malichky, Tr. 311-12 (*in camera*)).

176. Similarly, **{** [redacted] **}** (PX7033 (Post, Dep. at 153-54) (*in camera*)).

177. The TiO2 pricing in one region [redacted] (PX1456 at 001 (Duvekot email to Tan and Mouland) (**{** [redacted] **}**) (*in camera*); PX1451 at 001 (Duvekot email to Bradley) (*in camera*)).

178. Sherwin-Williams has **{** [redacted] **}** (Young, Tr. 673 (*in camera*); PX7020 (Young, Dep. at 70-71) (*in camera*)).

179. **{** [redacted] **}** (Malichky, Tr. 610 ({ [redacted] **}**) (*in camera*)).

180. Regional TiO2 prices may **{** [redacted] **}** (Malichky, Tr. 313 (*in camera*)).

181. **{** [redacted] **}** (PX7040 (Santoro, Dep. at 193) (*in camera*)).

182. **{** [redacted] **}** (PX7040 (Santoro, Dep. at 87-88) (*in camera*)).

183. **{** [redacted] **}** (PX7040 (Santoro, Dep. at 43-44) (*in camera*)).

184. Deceuninck NV, Deceuninck North America (DNA)'s parent company, is a multinational corporation, headquartered in Belgium, with operations in the Europe. (Arrowood, Tr. 1053). According to DNA's Mr. Arrowood, the formulas for the company's products

vary by region due to weather differences, customer demand differences, and differences in the number of TiO2 suppliers. (PX7030 (Arrowood, Dep. at 64-65)). For example, as compared to its European operations, in North America, DNA uses larger quantities of TiO2 in its vinyl products, very pure grades, and a different UV stabilizer. (PX7030 (Arrowood, Dep. at 65-66)).

185. For PPG, the markets for its products that use TiO2 differ by region. (PX7025 (Malichky, Dep. at 62)). For example, the automotive coatings market in China is different from that in Europe or Brazil. (PX7025 (Malichky, Dep. at 63)). Local differences in each region matter to PPG because the production lines are set up differently, the humidity and other coating parameters are different, and it uses local raw materials for its products. (PX7025 (Malichky, Dep. at 63)).

186. **{** **}** (PX7026 (Duvekot, Dep. at 87-89) (*in camera*); PX8003 at 006 (¶ 28) (Young Decl.) (*in camera*)).

187. According to Cristal's Mr. Stoll, **{** **}** (PX2245 (Stoll, Dep. at 82-84) (*in camera*)).

188. Sherwin-Williams, for example, has manufacturing in North and South America, Europe and Asia, but **{** **}** (PX8003 at 006 (¶ 28) (Young Decl.) (partially *in camera*)).

189. PPG has teams in different regions, with someone in each region performing the negotiations for TiO2 price and supply in that region. (Malichky, Tr. 270-71).

190. Likewise, {[redacted]} (PX7033 (Post, Dep. at 11-12) (*in camera*)).

191. According to Mr. Post of AkzoNobel, {[redacted]}. (PX7033 (Post, Dep. at 154) (*in camera*)). {[redacted]}. (PX7033 (Post, Dep. at 177) ({[redacted]}) (*in camera*)).

192. {[redacted]} because prices are {[redacted]} because of {[redacted]} so {[redacted]} (Young, Tr. 671-72 (*in camera*)). {[redacted]} (Young, Tr. 672-73 (*in camera*)).

193. {[redacted]} (PX7025 (Malichky, Dep. at 77, 81) (*in camera*); PX7043 (Gigou, Dep. at 83) (*in camera*); Young, Tr. 670-71 (*in camera*); Christian, Tr. 786-87; *see* CCFF ¶¶ 194-98, below).

194. For example, Deceuninck North America (DNA), a plastics manufacturer, has sourced all the TiO2 that it purchased in the United States from Tronox's Hamilton, Mississippi plant. (PX7030 (Arrowood, Dep. at 109)). The TiO2 is shipped by truck in supersacks to DNA's Ohio plant. (PX7030 (Arrowood, Dep. at 105)).

195. According to Mr. Arrowood of DNA, the important factors to consider when buying TiO2 are, in addition to price, a short lead-time for delivery, product quality, delivery reliability, and product performance characteristics (e.g., weatherability). (PX7030 (Arrowood, Dep. at 47, 148-52)).

196. DNA has not considered purchasing TiO2 from locations outside of North America because of the "problems that [one] can run into with transportation, with product taking an extremely long lead time to get to [DNA's] factory and just all the difficulties that you can face with transportation." (Arrowood, Tr. 1084).

197. {[redacted]} (Malichky, Tr. 310 (*in camera*)).

198. As Mr. Young of Sherwin-Williams testified, **{** [redacted] **}** (Young, Tr. 670-71 (*in camera*)).

(3) Tronox and Cristal's ordinary course documents and their executives' testimony confirm the regional nature of chloride TiO2 pricing and purchasing

199. Testimony and ordinary course documents from Tronox and Cristal confirm the market reality of regional pricing and purchasing of chloride TiO2. (*See* CCFF ¶¶ 200-25, below).

200. As Tronox's Mr. Mouland admitted, **{** [redacted] **}** (Mouland, Tr. 1173 (*in camera*)).

201. In March 2017, **{** [redacted] **}** Mr. Mouland responded by writing **{** [redacted] **}** (PX1682 at 001 (Mouland email to Larson) (*in camera*)).

202. In July 2016, Tronox's Mr. Mouland informed **{** [redacted]

[redacted] **}** (Mouland, Tr. 1177-78 (*in camera*); *see also* RX0281 at 001 (Mouland email) (*in camera*)).

203. In a September 2011 email, Mr. Mouland wrote to Mr. Duvekot: **{** [redacted] **}** (PX1085 at 001 (Mouland email to Duvekot) (explaining **{** [redacted] **}**) (*in camera*)).

204. **{** [redacted] **}** (PX1021 at 002 (Romano email to Turgeon) (*in camera*); *see also* PX9006 at 006 (Tronox Q2 2015 Earnings Call) (Tronox then-CEO noting that it did "not see that exports from China or from Europe are playing a material role in the competitive balance, particularly in the North American market."); *see also* PX2315 at 004 (Cristal presentation) ({ [redacted] }) (*in camera*)).

205. Likewise, **{** [redacted] **}** (PX2041 at 010 (Snider email with attachment) (*in camera*)).

206. **{** [redacted] **}** and explains that **{** [redacted]

[redacted] compared to its competitors. (PX2356 at 009 (Gunther email to Gigou with attachment) (*in camera*)).

207. Within the same September 2017 presentation, [redacted] and next to it, the slide specifies, [redacted] (PX2356 at 011 (Gunther email to Gigou with attachment) (*in camera*); PX2356 at 015-16 ([redacted]) (*in camera*)).

208. [redacted] (PX1006 at 010 (Tronox's Nov. 2016 TiO2 Review) (*in camera*)).

209. TiO2 suppliers [redacted], and therefore, [redacted]. (PX2252 at 051-52 (*In Re: Titanium Dioxide Antitrust Litigation*, Deposition Transcript of Jerry Bassett) (*in camera*); PX7043 (Gigou, Dep. at 84-86) ([redacted]) (*in camera*); *see also* Mei, Tr. 3177 (*in camera*) ([redacted]; PX7026 (Duvekot, Dep. at 80-81, 84-85) (acknowledging that [redacted] and that

{ }) (*in camera*)).

210. As Mr. Snider, Cristal's marketing director acknowledged, { } (PX7000 (Snider, IHT at 34-35 (*in camera*)).

211. The majority of TiO2 sold out of Tronox's chloride TiO2 manufacturing facilities is sold into the same region where each plant is located. (Quinn, Tr. 2418). Specifically, a significant majority of the sales coming out of Tronox's Hamilton, Mississippi plant serves the North American region. (Quinn, Tr. 2418).

212. Reflecting the market reality, (PX1006 at 010 (Tronox Nov. 2016 TiO2 Review) (*in camera*); PX1021 at 002 (Romano email to Turgeon) ({ }) (*in camera*); PX2025 at 008 (Cristal presentation) (*in camera*); PX2041 at 010 (Snider email with attachment) ({ }) (*in camera*); PX7037 (Pickett, Dep. at 46) (*in camera*); PX7043 (Gigou, Dep. at 14-15) ({ }) (*in camera*); PX2366 at 003 and PX2367 at 004 (Cristal spreadsheets) ({ }) (*in camera*)).

213. The regional nature of pricing for chloride TiO2 is **{** [redacted] **}** (*See* CCFF ¶¶ 214-23, below).

214. For example, **{** [redacted] **}** (Mouland, Tr. 1172 (*in camera*)).

215. Similarly, Mr. Romano explained during an investigational hearing, "**{** [redacted] **}** (PX7001 (Romano, IHT at 145-46) (*in camera*); *see also* Romano, Tr. 2152 (**{** [redacted] **}**) (*in camera*)).

216. Thus, Tronox's oft-repeated view on this issue is captured in an email from Mr. Mouland: **{** [redacted] **}** (PX1456 at 001 (Mouland email to Tan) (*in camera*)).

217. In 2014, Mr. Mouland of Tronox observed that **{** [redacted] **}** and noted that he had reiterated **{** [redacted] **}** (PX1301 at 001-02 (Mouland email to Duvekot and Romano) (*in camera*)).

218. A regular course business presentation from Cristal suggests that **{** **}**. (PX2116 at 013, 134 (Cristal August 2016 email with marketing and sales presentation attached) (*in camera*)).

219. **{** **}** (PX2245 at 083 (*In Re: Titanium Dioxide Antitrust Litigation*, Deposition Transcript of Mark Stoll) (*in camera*)).

220. According to Tronox, **{** **}** (PX1739 at 001 (Tronox March 2016 email) ({ **}**) (*in camera*)).

221. Similarly, in a 2015 internal email discussing negotiation strategies with one of its customers, Mr. Mouland of Tronox wrote that **{** **}** (PX1319 at 001 (Tronox October 2015 email from Mouland to Bradley) (*in camera*)).

222. Tronox informs its customers that **{** **}**. (PX1449 at 001 (February 2012 Tronox email) (*in camera*)).

223. As of March 2018, Tronox's practice of **{** **}** has continued. (PX7026 (Duvekot, Dep. at 87-88) (*in camera*)).

224. **{** [redacted] **}** (PX7043 (Gigou, Dep. at 83) (*in camera*)).

225. In the price-fixing litigation, Cristal's former global accounts manager testified that **{** [redacted] **}** (PX2252 at 040 (*In Re: Titanium Dioxide Antitrust Litigation*, Deposition Transcript of Jerry Bassett) (**{** [redacted] **}**) (*in camera*)).

(4) Testimony from other chloride TiO2 producers also confirms the regional nature of chloride TiO2 pricing and purchasing

226. Other TiO2 producers also employ regional pricing based on regional competitive conditions. (*See* CCFF ¶¶ 227-31, below).

227. For example, **{** [redacted] **}**. (PX8002 at 004 (¶ 15) (Christian Decl.) (*in camera*) ("**{** [redacted] **}**"); Christian, Tr. 931 (**{** [redacted] **}**) (*in camera*)).

228. For Kronos, **{** [redacted] **}**. (PX3038 at 34 (**{** [redacted] **}**) (*in camera*)).

229. Venator assesses its TiO2 business on both a global and regional basis. (PX8005 at 004 (¶ 23) (Maiter Decl.) ("At any given time, the competitive dynamics in each region may vary, so we also analyze demand and supply conditions, pricing, and financial performance by region on a monthly and quarterly basis.")). **{** **}**. (PX7015 (Maiter, Dep. at 135) (*in camera*)).

230. Mr. O'Sullivan of Chemours stated that **{** **}** (PX8004 at 002 (¶ 7) (O'Sullivan Decl.) (*in camera*)). Chemours further explains that **{** **}**. (PX8004 at 002 (¶ 7) (O'Sullivan Decl.) (*in camera*)).

231. Like other TiO2 producers, Chemours organizes its chloride TiO2 businesses **{** **}** (PX8004 at 002 (¶ 7) (O'Sullivan Decl.) (*in camera*)).

(5) Between 2012 and 2016, North America sustained higher prices for chloride TiO2 compared to the rest of the world

232. Although regional prices vary relative to one another, at least between 2012 and 2016, TiO2 prices in North America remained significantly higher than those elsewhere in the world. (*See* CCFF ¶¶ 233-58, below).

233. North American TiO2 prices are traditionally higher than other regions because of supply and demand conditions. (PX8003 at 006 (¶ 27) (Young Decl.)).

234. **{** [redacted] **}** (Young, Tr. 673-74 (*in camera*)).

235. Similarly, in an email to a Tronox TiO2 sales manager, **{** [redacted] **}**. (RX0504 at 0001 (Doherty email) (*in camera*)).

236. Dr. Hill determined in his analysis, based on invoice data from Tronox and Cristal, that North American TiO2 customers consistently paid **{** [redacted] **}** for products made at Respondents' North American factories. (Hill, Tr. 1722-24 (partially *in camera*); PX5000 at 063-64 (¶ 144 & Fig. 24) (Hill Initial Report) (*in camera*); Shehadeh, Tr. 3633 (**{** [redacted] **}**) (*in camera*)).

237. Based on his economic analysis of Tronox and Cristal data, Dr. Hill concluded that there are **{** [redacted] **}**. (Hill, Tr. 1723 (*in camera*); PX5004 at 035-36 (¶ 83 & Fig.13) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

238. In addition to the descriptive analysis, Dr. Hill also performed a quantitative economic analysis—a "hedonic regression"—with customer-grade level data and concluded that even for a particular customer for a particular grade, the price in North America has been higher than the price in other regions. (Hill, Tr. 1723-24; PX5004 at 073 (¶¶ 173-74, 176) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

239. Other evidence also shows that North American producers charged higher prices in North America compared to other regions of the world between 2012 and 2016. (*See* CCFF ¶¶ 240-58, below).

240. Mr. Romano of Tronox acknowledged that **{** [redacted] **}** (Romano, Tr. 2177 (*in camera*); PX1349 at 009 (*in camera*)).

241. **{** [redacted] **}** (Romano, Tr. 2179-80 (*in camera*); PX1111 at 002 (*in camera*)).

242. **{** [redacted] **}** (Romano, Tr. 2181 (*in camera*); PX1620 at 025 (*in camera*)).

243. According to a June 2016 document from Tronox, **{** [redacted] **}** (Romano, Tr. 2185-86 (*in camera*); PX1008 at 011 (*in camera*)).

244. In a May 2016 email **{** **}**, Mr. Romano wrote to Ms. Staton, CFO for Tronox's TiO2 business, **{** **}** (RX0250 at 0001 (Romano email to Staton and Turgeon) (*in camera*)). According to the data included in the same email chain, **{** **}**. (RX0250 at 0002 (Tronox email) (*in camera*)).

245. **{** **}** (PX7052 (O'Sullivan, Dep. at 145-47) (*in camera*); *see also* PX8004 at 002 (¶ 7) (O'Sullivan Decl.) (*in camera*)). **{** **}** (PX7052 (O'Sullivan, Dep. at 145-47) (*in camera*)).

246. As Mr. Maiter of Venator testified, **{** **}** (PX7015 (Maiter, Dep. at 180-81) (*in camera*)).

247. Between 2011 and 2016, the price PPG was charged for chloride TiO2 in the United States was higher, on average, than in other parts of the world. (PX8000 at 002 (¶ 7) (Malichky Decl.)).

248. In Tronox's **{** **}**, Mr. Mouland reported to Mr. Romano: **{** **}** (PX1105 at 003 (Tronox email with attachment) (*in camera*)).

249. In March 2013, "[m]arkets in North America are still under pressure to decline since they are so much higher than the other regions of the world, however, [Cristal] [is] trying to hold on to the current price levels." (PX2030 at 003 (Stoll email to Nahas)).

250. A Tronox presentation emailed in December 2013 notes that **{** **}** (PX1349 at 009 (Tronox presentation) (**{** **}**) (*in camera*)).

251. In a January 2015 email, Tronox's Mr. Duvekot noted that **{** **}** (PX1317 at 001 (Duvekot email to Romano) (*in camera*)).

252. In a 2015 earnings call, Tronox reported that TiO2 prices in North America were higher than the TiO2 prices in the European, Asian and Latin American markets. (PX9008 at 008 (Tronox Q4 2015 Earnings Call) (Tronox then-CEO stating "[A]re there different

prices in the regional markets in which we do business? The answer to that question is yes.")).

253. A Tronox June 2016 presentation shows that **{** [redacted] **}** (PX1008 at 011 (Tronox TiO2 Variance Analysis) (*in camera*)).

254. A March 2015 Cristal report acknowledges that **{** [redacted] **}** (PX2050 at 005 (Cristal email with report attached) (*in camera*)).

255. A September 2016 Cristal email refers to **{** [redacted] **}**. (PX2027 at 001 (Cristal email) (*in camera*)).

256. Another September 2016 Cristal email **{** [redacted] **}** (PX2039 at 001 (Cristal email) (*in camera*)).

257. In a 2016 earnings call, Tronox reports that TiO2 prices in Europe and Asia were lower than prices in North America. (PX9001 at 007 (Tronox Q3 2016 Earnings Call) ("[O]ur view is that prices in Europe and in Asia were lower than prices in the United States and in other North American -- the other North American markets.")).

258. After more than five years of higher North American prices, **{** [redacted] **}** (PX5004 at 039 (¶ 90 & Fig. 17) (Hill Rebuttal Report to Shehadeh) (European prices spiked **{** [redacted] **}** because of a fire at a TiO2 plant in Pori, Finland in early 2017, which caused a severe shortage.) (*in camera*); *see also* PX1437 at 019 (Tronox presentation) ({ [redacted]

[redacted]

[redacted]}) (*in camera*)). {[redacted]

[redacted]

[redacted]

[redacted]} (PX1437 at 019 (Tronox 2017 Presentation) (*in camera*); PX7015 (Maiter, Dep. at 164, 217); Hill, Tr. 1820-1822 (*in camera*); PX5004 at 039 (¶¶ 89-90 & Fig. 17) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

(b) Arbitrage by customers is inadequate to defeat a price increase in North America

259. Within the framework of section 4.2.2, the Horizontal Merger Guidelines focus on whether customers can engage in arbitrage by buying a product in a low-priced region and the customer being responsible for arranging transportation, duties, costs etc. to move the product itself to another region. (PX9085 at 017-18 (Horizontal Merger Guidelines, § 4.2.2); Hill, Tr. 1714-15, 1720; Duvekot, Tr. 1303-05 ({[redacted]

[redacted]

[redacted]}) (*in camera*)).

260. Customers universally testified that they do not engage in arbitrage of chloride TiO2 in North America. (*See* CCFF ¶¶ 272-77, below).

261. North American customers testified that the cost of transportation and duties as well as the logistical burdens render arbitrage not commercially viable and thus, customers in North America would not likely defeat a 5-10% price increase by a hypothetical monopolist through arbitrage. (*See* CCFF ¶¶ 283-89, 295-99, below).

262. Chloride TiO2 is **{** [redacted] **}** (PX8005 at 004 (¶ 20) (Maiter Decl.) (*in camera*)).

263. As Tronox's Mr. Duvekot acknowledges, **{** [redacted] **}** (Duvekot, Tr. 1302-03 (*in camera*); PX1085 at 001 (*in camera*)).

264. Based on documents, testimony and economic analysis, Dr. Hill concluded that **{** [redacted] **}** (Hill, Tr. 1721-22 (partially *in camera*)). Based on a quantitative analysis using the invoice data, Dr. Hill also concluded that **{** [redacted] **}** (Hill, Tr. 1722-23 (partially *in camera*)).

265. There also are major logistical challenges for the import of TiO2 from overseas, not the least of which is the fact that **{** [redacted] **}** of the chloride TiO2 sold in North America is in slurry form. (PX5000 at 017 (¶ 39) (Hill Initial Report) (*in camera*); *see* CCFF ¶¶ 313-22, below). Other logistical challenges include storage issues, shipping lead times (and potential delays), and provision of local technical service. (PX7054 (O'Malley Noe, Dep. at 65 (**{** [redacted] **}**) (*in camera*)).

266. Consistent with the testimony, documents, and economic analysis, the persistent regional pricing gap shows that **{** [redacted]

[redacted] (*See* CCFF ¶¶ 232-58, above; Hill, Tr. 1720-1725 (partially *in camera*); PX5000 at 063-064 (¶ 144 & Fig. 24) (Hill Initial Report) (*in camera*)). There is also no evidence that North American customers purchase chloride TiO2 indirectly from or through other customers to exploit regional price differences. (Shehadeh, Tr. 3567).

(1) Arbitrage is expensive and impractical

267. For all of the reasons explained in this section, customers would not be able to defeat a small, but significant North American chloride TiO2 price increase through arbitrage. (*See* CCFF ¶¶ 272-77, 283-89 below).

268. Tronox admits that [redacted]. (PX0003 at 038 (Tronox September 2017 Narrative Responses) (*in camera*)).

269. In September 2011, Tronox's Mr. Duvekot noted that [redacted] (Duvekot, Tr. 1302-03 (*in camera*)). [redacted] (PX1085 at 001 (Duvekot email to Mouland) (*in camera*)).

270. [redacted] (Duvekot, Tr. 1302-05 (*in camera*)).

271. [redacted] (Duvekot, Tr. 1307 (*in camera*)).

{ [redacted] **}** (Duvekot, Tr. 1304-05 (*in camera*)).

272. TiO2 customers find that **{** [redacted] **}** (PX7016 (DeCastro, Dep. at 87-88) (*in camera*)).

273. Likewise, according to PPG, **{** [redacted] **}** (Malichky, Tr. 310-11 (*in camera*)).

274. As True Value testified, it is important **{** [redacted] **}** (Vanderpool, Tr. 199 (*in camera*)).

275. **{** [redacted] **}.** (Vanderpool, 199-200 (*in camera*)).

276. Deceuninck North America (DNA) does not even consider purchasing TiO2 from outside of North America because of the problems that can occur with transportation and long lead times. (Arrowood, Tr. 1084).

277. **{** [redacted] **}** (Young, Tr. 674, 735 (*in camera*)).

278. **{** [redacted] **}** (PX2253 at 037 (*In Re: Titanium Dioxide Antitrust Litigation*, Deposition Transcript of Michael Card) (*in camera*)).

279. As Cristal's then-sales manager, Mr. Bassett, explained during a deposition taken for one of the price fixing litigations, **{** [redacted] **}** (PX2252 at 051-52 (*In Re: Titanium Dioxide Antitrust Litigation*, Deposition Transcript of Jerry Bassett) (*in camera*)).

280. **{** [redacted] **}** (PX1372 at 020 (Tronox May 2014 email with strategic plan presentation attached) (**{** [redacted] **}**) (*in camera*)).

281. For example, **{** [redacted] **}** (PX8005 at 004 (¶ 20) (Maiter Decl.) (*in camera*)).

282. For Kronos, **{** [redacted] **}** (PX8002 at 003 (¶ 14) (Christian Decl.) (*in camera*)).

283. **{** [redacted] **}** (PX7025 (Malichky, Dep. at 97) (*in camera*)).

284. **{** [redacted] **}** (PX7025 (Malichky, Dep. at 97-98) (*in camera*)).

285. **{** [redacted] **}** (Malichky, Tr. 315-16 (*in camera*)).

286. **{** [redacted] **}** (PX7002 (Mouland, IHT at 69, 103-04) (**{** [redacted] **}**) (*in camera*); PX1000 at 005 (Tronox 2016 presentation) (**{** [redacted] **}**) (*in camera*); PX5000 at 066 (¶ 148) (Hill Initial Report) (*in camera*)).

287. **{** [redacted] **}** (PX7033 (Post, Dep. at 162) (*in camera*)).

288. **{** [redacted] **}** (PX7033 (Post, Dep. at 162) (*in camera*)).

289. **{** [redacted] **}** (PX7033 (Post, Dep. at 162-164) (*in camera*)).

290. Based on his review of the record, Dr. Hill has concluded that the transportation of TiO2 is costly due to transportation costs and import duties. (Hill, Tr. 1876-77).

(2) North American customers do not engage in meaningful arbitrage today and cannot arbitrage in sufficient quantities to defeat a small but significant price increase

291. The qualitative and quantitative evidence, including customer testimony, make it clear that **{** [redacted] **}** (PX7016 (DeCastro, Dep. at 51-52) (*in camera*)).

292. In fact, Tronox acknowledged that **{** [redacted] **}** (Duvekot, Tr. 1303 (in camera)).

293. In 2012, a Cristal sales executive testified that **{** [redacted] **}** (PX2252 at 042 (*In Re: Titanium Dioxide Antitrust Litigation*, Deposition Transcript of Jerry Bassett) (*in camera*)).

294. **{** [redacted] **}** (Malichky, Tr. 314 (*in camera*)).

295. **{** [redacted] **}** (Malichky, Tr. 315-16 (*in camera*); PX7025 (Malichky, Dep. at 96-98) (*in camera*)).

296. **{** [redacted] **}** (PX8000 at 002 (¶ 7) (Malichky Decl.) (*in camera*)). For example, **{** [redacted] **}** (Malichky, Tr. 317-319 (*in camera*)).

297. Likewise, **{** [redacted] **}** (Young, Tr. 674 (*in camera*); PX7020 (Young, Dep. at 169) (*in camera*)).

298. When TiO2 prices in North America were higher than those in Europe, Deceuninck North America (DNA) looked into possibly moving TiO2 from one of Deceuninck's European plants to DNA's Monroe, Ohio plants, but decided not to do that because "the cost, transportation cost, is very expensive to get the titanium dioxide from Europe to the U.S., the economics didn't make sense for us to do that. . . ." (Arrowood, Tr. 1089-90).

299. In the last 30 years, DNA has never turned to European or Chinese TiO2 suppliers when North American TiO2 prices have increased. (Arrowood, Tr. 1095-97).

300. After considering documents, testimony and engaging in an economic analysis, Dr. Hill concluded that **{** [redacted] **}** (Hill, Tr. 1724-25 (*in camera*)).

(c) North American customers have distinct product demands and requirements

301. Market participants testified that TiO2 customers in North America have distinct demand characteristics that separate the North American TiO2 demand from those in other regions. (*See* CCFF ¶¶ 302-22, below). North American consumers of TiO2 value quality of TiO2 much more than customers in other geographic regions, and thus overwhelmingly use chloride TiO2 in North America. (*See* CCFF ¶¶ 31-92, above). This makes it significantly more difficult to arbitrage because the TiO2 produced in other regions, much of which is sulfate TiO2, is unlikely to meet the stringent requirements that North American customers require. (*See* CCFF ¶¶ 302-12, below).

302. North American TiO2 customers are more developed and have a higher degree of technical and customer service requirements. (Christian, Tr. 786-87).

303. Mr. Christian of Kronos testified that quality of TiO2 is more important to North American TiO2 customers than to TiO2 customers in other locations. (Christian, Tr. 779-80 ("The more developed economies and parts of the world I think it's going to matter

more towards, because we have a saying that TiO2 is a quality of life product, and as your quality of life as a society improves on a per capita basis, you tend to consume more TiO2, but you also have higher standards for products . . . .")).

304. **{** [redacted] **}** (PX7035 (Christian, Dep. at 184-85) (*in camera*)).

305. Because of the quality, technical, customer service and reputation requirements, **{** [redacted] **}** (PX8003 at 003 (¶12) (Young Decl.) (*in camera*); PX8000 at 003 (¶ 15) (Malichky Decl.) (*in camera*); PX8006 at 002 (¶ 8) (Pschaidt Decl.) (*in camera*); PX7044 (Vanderpool, Dep. at 87-91, 99-100) (*in camera*); *see* CCFF ¶¶ 31-92, above).

306. As Sherwin-Williams explained, sulfate TiO2 is not suitable for paint formulations in North America, **{** [redacted] **}** (Young, Tr. 642-44, 664-65 (partially *in camera*)).

307. Based on the qualitative and quantitative evidence, Dr. Hill concluded that "in North America, chloride titanium dioxide accounts for on the order of 90 percent of rutile titanium dioxide sales, and in other regions around the world, the proportion of sulfate is typically significantly higher." (Hill, Tr. 1677).

308. North American TiO2 customers consume **{** [redacted] **}** (PX8004 at 002 (¶ 7) (O'Sullivan Decl.) (*in camera*)).

309. {[redacted]} (PX7020 (Young, Dep. at 136) (*in camera*)).

310. {[redacted]} (Young, Tr. 676-77 (*in camera*)). Mr. Young further explained that {[redacted]} (Young, Tr. 677 (*in camera*)).

311. Quality standards are different for South America versus North America in part because labor is cheaper in South America so repainting frequently is not a problem. In contrast, in North America, many paint products have multi-year warranties. Also, North America is a tint market. (PX7020 (Young, Dep. at 133-34) ("In addition, as I mentioned earlier, North America is a tint market, so the color standards of the product in the can have to be very, very tightly monitored and with low tolerances so that when we do inject the colorant, we get the color we anticipate at the end.")).

312. According to Sherwin-Williams's Mr. Young, prices are traditionally higher in North America because consumers there want higher quality paints and that requires using chloride TiO2. (PX7020 (Young, Dep. at 141)).

313. In addition to requiring chloride TiO2, North America TiO2 demand is unique in that many coatings customers demand chloride TiO2 in slurry form, as opposed to dry TiO2,

which makes arbitrage even more difficult, if not impossible, for these customers. (*See* CCFF ¶¶ 314-22, below). {[redacted]} (PX7027 (Pschaidt, Dep. at 115) (*in camera*)).

314. {[redacted]} (PX8004 at 002 (¶ 7) (O'Sullivan Decl.) (*in camera*) ({[redacted]}).

315. In North America, {[redacted]} (PX7035 (Christian, Dep. at 202-03) (*in camera*)). North American coatings customers rely on slurry TiO2 {[redacted]} (Young, Tr. 648-50; Malichky, Tr. 294 (*in camera*); PX8006 at 002 (¶ 9) (Pschaidt Decl.) (*in camera*)).

316. {[redacted]} (PX7035 (Christian, Dep. at 185) ({[redacted]}) (*in camera*)).

317. {[redacted]} (PX8002 at 003 (¶ 13) (Christian Decl.) (*in camera*)).

318. {[redacted]} (PX8004 at 002 (¶ 7) (O'Sullivan Decl.) (*in camera*)).

319. About {[redacted]} of the TiO2 that Sherman-Williams purchases is in slurry form. Using TiO2 in slurry form allows Sherman-Williams to efficiently handle bulk deliveries of universal grades, and slurry TiO2 can be pumped directly into storage tanks Sherman-Williams has on-site. (PX8003 at 002 (¶ 9) (Young Decl.) (partially *in camera*)).

320. {[redacted]} (Malichky, Tr. 529 (*in camera*)). {[redacted]} (PX8000 at 004 (¶ 17) (Malichky Decl.) (*in camera*)).

321. {[redacted]} (Malichky, Tr. 305, 310 (*in camera*); Young, Tr. 670-71 (*in camera*)). {[redacted]} (Malichky, Tr. 305 (*in camera*); *see also* PX7041 (Veazey, Dep. at 53-54) ({[redacted]}) (*in camera*)). {[redacted]} (Malichky, Tr. 305-06 (*in camera*); Young, Tr. 682-83 (*in camera*)). {[redacted]} (Malichky, Tr. 305-06 ({[redacted]}

[redacted]**}**) (*in camera*); Young, Tr. 682-83 (**{**[redacted]**}**) (*in camera*)).

322. As Tronox acknowledges, **{**[redacted]**}** (PX1322 at 003 (Tronox presentation) (*in camera*)).

iii. The Market for the Sale of Chloride TiO2 to North American Customers Passes the Hypothetical Monopolist Test

323. The qualitative evidence discussed above is consistent with the quantitative evidence, demonstrating that the sale of chloride TiO2 in North America is the relevant market. (*See* CCFF ¶¶ 324-29, below). The hypothetical monopolist test indicates that demand for chloride TiO2 is strong in North America and customers are unlikely to switch to sulfate TiO2 in significant amounts, in the face of a SSNIP. (*See* CCFF ¶¶ 327-29, below; Hill, Tr. at 1698-99). Therefore, the sale of chloride TiO2 to North American customers is a relevant market. (*See* CCFF ¶ 329, below).

324. Under the Horizontal Merger Guidelines, the hypothetical monopolist test is used as a framework to determine whether a relevant market is properly defined. (PX9085 at 011-12 (Horizontal Merger Guidelines, § 4.1.1)). In applying the test, the analysis focuses on whether it would be profit maximizing for a hypothetical monopolist of all sales in a specific region to increase price by a least a SSNIP, commonly five percent. (PX9085 at 013 (Horizontal Merger Guidelines, § 4.1.2)). If the hypothetical monopolist can

successfully impose a SSNIP in the proposed market, the relevant market is defined correctly. (PX9085 at 013 (Horizontal Merger Guidelines, § 4.1.2)).

325. Critical loss analysis is a standard tool used to implement the hypothetical monopolist test to determine whether a candidate market constitutes a relevant antitrust market. (PX9085 at 014-15 (Horizontal Merger Guidelines, § 4.1.3) (discussing using critical loss analysis to implement the hypothetical monopolist test.); Hill, Tr. at 1691). A critical loss analysis determines whether it would be profitable for the hypothetical monopolist to increase the price by at least a SSNIP. (PX9085 at 014-15 (Horizontal Merger Guidelines, § 4.1.3); PX5000 at 050 (¶ 107) (Hill Initial Report) (*in camera*)).

326. A critical loss analysis compares two quantities: (1) a critical loss, which is the percentage of sales a hypothetical monopolist would have to lose to keep its profit unchanged if it increased its price by a SSNIP; and (2) a predicted loss, which is the percentage of sales that the hypothetical monopolist would likely lose if it increased its price by the same amount used in the critical loss analysis. (PX9085 at 014-15 (Horizontal Merger Guidelines, § 4.1.3); PX5000 at 049 (¶ 106) (Hill Initial Report) (*in camera*)).

327. Dr. Hill implemented the hypothetical monopolist test in four different ways, including using Respondents' own documents and conclusions, to test whether chloride TiO2 sold to North American customers is a relevant antitrust market. (Hill, Tr. at 1690). Dr. Hill conducted three separate critical loss analyses to test the robustness of the results. (PX5000 at 050-56 (¶¶ 108-22 & Figs. 20-22) (Hill Initial Report) (*in camera*); Hill, Tr. at 1696-98). Each critical loss analysis used a different estimate of the predicted loss: (1) Dr. Hill's estimate for price elasticity of demand; (2) Respondents' estimated relationship

between price and net imports; and (3) Tronox's estimate of maximum North American sulfate demand. (PX5000 at 050-56 (¶¶ 108-22 & Figs. 20-22) (Hill Initial Report) (*in camera*); Hill, Tr. at 1691-92). Each of these analyses demonstrated that chloride TiO2 sales to North American customers passes the hypothetical monopolist test. (PX5000 at 050-56 (¶¶ 108-22 & Figs. 20-22) (Hill Initial Report) (*in camera*)).

328. The fourth method that Dr. Hill used to implement the hypothetical monopolist test was based on the price elasticity of demand for chloride TiO2 in North America. (PX5000 at 056-58 (¶¶ 123-29 & Fig. 23) (Hill Initial Report) (*in camera*); Hill, Tr. at 1692-96). Dr. Hill found that the price elasticity of demand for chloride TiO2 after a 5% SSNIP is still inelastic, and therefore chloride TiO2 in North America passes the hypothetical monopolist test based on the price elasticity of demand. (PX5000 at 056-58 (¶¶ 123-29 & Fig. 23) (Hill Initial Report) (*in camera*); Hill, Tr. at 1692-96).

329. The hypothetical monopolist test, implemented in four different ways as described above, indicated that demand for chloride TiO2 is strong and that North American customers will not substitute to sulfate TiO2 in significant amounts in the face of a SSNIP. (Hill, Tr. at 1698; PX5000 at 050-58 (¶¶ 108-29 & Figs. 20-23) (Hill Initial Report) (*in camera*)). Therefore, chloride TiO2 sold to North American customers is a relevant market. (Hill, Tr. at 1696-98; PX5000 at 050-58 (¶¶ 108-29 & Figs. 20-23) (Hill Initial Report) (*in camera*)).

B. Alternatively, the Sale of Rutile TiO2 to Customers in North America Is Also a Relevant Market

i. For North American Customers, There Are No Substitutes for TiO2

330. It is uncontested that North American TiO2 customers cannot substitute another product to replace their use of TiO2. (*See* CCFF ¶¶ 331-32, below).

331. In fact, Tronox and Cristal have conceded that the appropriate product market is not broader than rutile TiO2. (Respondents' Pre-Trial Brief at 24; RX0170 at 0142 (Shehadeh Report) (¶ 246) (*in camera*)).

332. TiO2 is a critical input for many products and Tronox and North American customers agree that **{** [redacted] **}** (PX8006 at 001 (¶5) (Pschaidt Decl.) (*in camera*); PX7049 (Zamec, Dep. at 102-03) (*in camera*); PX8000 at 001 (¶ 4) (Malichky Decl.); PX1073 at 117 (2012 Bain Presentation to the Tronox Board) (*in camera*); PX7002 (Mouland, IHT at 38-40) (*in camera*); PX8002 at 001 (¶4) (Christian Decl.) (*in camera*); PX8005 at 001 (¶4) (Maiter Decl.); PX3011 at 012, 019 (Kronos Investor Presentation); PX9104 at 042 (Tronox 10-K) (stating "it is our belief that there is no effective mineral substitute for TiO2."); Pschaidt, Tr. 978-79 (*in camera*); Vanderpool, Tr. 174; Malichky, Tr. 273-74; PX8003 at 002 (¶6) (Young Decl.) (*in camera*); PX7034 (Septien, Dep. at 17) (*in camera*); PX7014 (Quinn, Dep. at 119-20) (*in camera*); PX1000 at 006 (2016 Tronox Strategy Document) (*in camera*); Arrowood, Tr. 1062 ("Without [TiO2], essentially, our factory would be shut down.")).

ii. Anatase TiO2 Is Not a Substitute for Rutile TiO2 and Should Be Excluded

333. Commercially produced TiO2 comes in two crystalline forms: rutile and anatase. (PX9023 at 103 (TZMI TiO2 Pigment Annual Review: A Review of 2014); PX9020 at 013 (Chemical Economics Handbook)).

334. Respondents admit that anatase TiO2 should not be included in the relevant antitrust product market. (Respondents' Pre-Trial Brief at 24 (asserting a rutile only TiO2 market)).

335. Respondents admit that "anatase TiO2 is not at issue here." (Respondents' Pre-Trial Brief at 4, fn.1).

336. Respondents admit that anatase, with its different crystalline structure, and hence different properties, is used in different applications than rutile. (Respondent's Pretrial Brief at 4, fn.1). In a White Paper submitted to the FTC Bureau of Competition, Respondents explained:

{[redacted]}

(RX0190 at 032 (White Paper on Behalf of Tronox) (*in camera*)). Respondents admit that only "about ten percent of the world's TiO2 production is anatase" and that Tronox produces none. (Respondent's Pretrial Brief at 4, fn.1).

337. Anatase and rutile TiO2 exhibit significantly different properties as shown in the following chart:

PROPERTY	**Anatase TiO2**	**Rutile TiO2**
Refractive Index	2.5	2.7
Specific Gravity	3.9	4.2

Hardness (Mohs Scale)	5.5	6.5
Colour	Yellow/White	Blue/White
Relative Hiding Power	78%	100%
Ultra-violet light Absorption	Partial	Complete
Chalking	Free	Retarded

(PX1323 at 005 (TZMI Congress Presentation), *see also*, PX9020 at 013 (Chemical Economics Handbook); PX9023 at 103 (TZMI TiO2 Pigment Annual Review: A Review of 2014); PX0012 at 005 (Response to Fifth Request for Information) ({ }) (*in camera*); Christian, Tr. at 782 (Anatase TiO2 has a different type of crystal.)).

338. The differences in the properties between the rutile and anatase crystals means they tend to be suitable for significantly different applications, and are not substitutes. (PX9022 at 119-20 (Venator SEC Filing); PX9020 at 014, 051 (Chemical Economics Handbook); PX1289 at 021 (TZMI presentation) (distinguishing between anatase for specialty products and rutile for coatings); PX7002 (Mouland, IHT at 44-45) ({ }) (*in camera*); PX7000 (Snider, IHT at 80) (*in camera*); PX8004 at 001 (¶ 3) (O'Sullivan Decl.) (*in camera*)). For example, rutile TiO2, a more durable compound, is used in inks, paints, and plastic products, while anatase, a softer form of the pigment, is used in paper, ceramics, rubber, fibers (*e.g.*, textiles), pharmaceuticals, cosmetics, sunscreen and food products. (PX7035 (Christian, Dep. at 246) (*in camera*); RX0069 at

013 ({[redacted]}) ({[redacted]}) (*in camera*); PX7000 (Snider, IHT at 80-82) (*in camera*); PX8004 at 001 (¶ 3) (O'Sullivan Decl.) (*in camera*); PX9020 at 013-14, 005 (Chemical Economic Handbook)).

339. Rutile TiO2 is used in products exposed to outdoor conditions and products requiring a harder, more durable crystal. (PX9022 at 120 (Venator SEC Filing); PX9020 at 013 (Chemical Economics Handbook); PX9022 at 120 (rutile preferred for architectural and industrial coatings, plastics (e.g., PVC and masterbatch), and printing inks)).

340. With its lower abrasiveness, anatase TiO2 is used in specialty products such as cosmetics, rubber, paper, pharmaceuticals, and fibers (*i.e.*, textiles). (PX7002 (Mouland, IHT at 44-45) (*in camera*); PX9022 at 120 (Venator SEC Filing)). For example, Kronos's sulfate plant produces a high-purity anatase TiO2 used in cosmetic and personal care products (*e.g.*, skin cream, lipstick, eye shadow and toothpaste), and food products (*e.g.,* candy and confectionaries, and in pet foods). The anatase TiO2 pigment provides uniformity of color and appearance in these products. (PX1243 at 008 (Kronos, 2014 SEC 10-K Filing)). Additionally, anatase TiO2 is used in some coatings products for which quality is less important. (PX9020 at 014 (Chemical Economics Handbook) (*e.g.*, cheap emulsion paints, tiles, and enamels)).

341. A TZMI report describes rutile-only applications as: i) "decorative top-coat applications" because anatase grades "do not provide the bright colours desired . . ." and ii) "[d]urable protective coatings – most require rutile , which has excellent UV resistance and withstands harsh weather conditions better." Anatase-only applications include

"uncoated free sheet paper," and "specialty products (food, pharmaceuticals, cosmetics, fibres, photocatalysts, etc.)." (PX1289 at 021 (TZMI presentation)).

342. By volume, the largest commercial applications for TiO2 are architectural coatings, industrial coatings, and plastics (*i.e.*, 86% of TiO2 world consumption). (PX9020 at 009 (Chemical Economics Handbook); PX0001 at 011 (Tronox-Cristal Joint Presentation to the FTC) ({ }) (*in camera*); PX1323 at 008 (TZMI Congress Presentation)). Because these applications primarily use rutile TiO2, anatase TiO2 only accounts for 10% of global TiO2 production. (PX9020 at 014 (Chemical Economics Handbook); PX9023 at 024 (TZMI TiO2 Pigment Annual Review: A Review of 2014); PX7016 (DeCastro, Dep. at 96) (Coatings customer only buys rutile TiO2 -- no anatase TiO2.)).

343. Due to its performance differences, regular anatase TiO2 { } (PX7043 (Gigou, Dep. at 23) (*in camera*); *see also* PX2366 and PX2367 (Cristal spreadsheets) ({ }) (*in camera*)). { } (PX8005 at 001-002 (¶ 6) (Maiter Decl.) (*in camera*)).

344. Due to performance differences, paint and coatings customers are not likely to switch to anatase TiO2 from rutile TiO2 in response to a SSNIP. (PX7020 (Young, Dep. at 155) ({ }) (*in camera*); PX7031 (Shah, Dep. at 16) (BASF, a coatings manufacturer, does not buy anatase TiO2 in North America.)).

345. {[redacted]} (PX7035 (Christian, Dep. at 116-17) (*in camera*); PX7002 (Mouland, IHT at 44) ({[redacted]}) (*in camera*)).

iii. The Market for the Sale of Rutile TiO2 to North American Customers Passes the Hypothetical Monopolist Test

346. After reviewing qualitative and quantitative information and conducting economic analysis consistent with the Horizontal Merger Guidelines, Dr. Hill concluded that rutile TiO2 is also a relevant product. (PX5000 at 129-30 (¶¶ 284-90) (Hill Initial Report) (*in camera*)). Dr. Hill conducted the hypothetical monopolist test and concluded that sales of rutile TiO2 to customers in North America passed the hypothetical monopolist test. (Hill, Tr. 1754; PX5000 at 131 (¶¶ 291-92 & Fig. 41) (Hill Initial Report) (*in camera*)).

347. The hypothetical monopolist test asks whether a hypothetical monopolist could profitably implement a small but significant non-transitory price increase (SSNIP) to customers in North America, or whether North American customers would switch to another product or stop purchasing TiO2 at amounts sufficient to render the SSNIP unprofitable. (PX9085 at 011-14 (Horizontal Merger Guidelines, §§ 4.1.1, 4.1.2)).

348. Dr. Hill noted that the record is replete with evidence that customers have no practical substitutes for rutile TiO2. (PX5000 at 129-30 (¶¶ 285-88) (Hill Initial Report) (*in camera*)).

349. Dr. Hill explained that the price elasticity of demand for a product measures how demand responds to changes in price, and noted that inelastic demand is a sign that a product does not have close substitutes. (PX5000 at 130 (¶ 289) (Hill Initial Report) (*in camera*)).

350. Dr. Hill explained that demand for a product is inelastic if a one percent change in its price changes its demand by less than one percent. He estimated the price elasticity of demand for rutile TiO2 to be **{** [redacted] **}** (PX5000 at 130-31 (¶¶ 289-91, n.533) (Hill Initial Report) (*in camera*)).

351. Dr. Hill applied critical loss analysis, using his price elasticity of demand estimate, to a putative North American rutile TiO2 market and found that a hypothetical ten percent price increase yielded a predicted loss of **{** [redacted] **}** (PX5000 at 131-32 (¶¶ 291-292 & Fig. 41) (Hill Initial Report) (*in camera*)).

352. Dr. Hill concludes that the "sale of rutile titanium dioxide in North America therefore passes the hypothetical monopolist test and is a relevant product." (Hill, Tr. 1754; PX5000 at 131 (¶ 292) (Hill Initial Report) (*in camera*)).

C. Dr. Shehadeh's Analysis of Market Definition Is at Odds with the Facts and Established Market Definition Principles

i. The Quantitative Tools for Analyzing the "Comovement" of Data Series Are Unreliable for Defining Antitrust Markets

353. In defining both his relevant product and geographic market, Dr. Shehadeh analyzes the "comovement" of different price series. (Shehadeh, Tr. 3229-43, 3284, 3286-3290).

354. The statistical approaches that Dr. Shehadeh uses to analyze comovement, however, are unreliable for purposes of antitrust market definition. (Hill, Tr. at 1706-10; PX5004 at 022 (Section 2.D) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

355. Correlation analysis is prone to false positives that stem from common demand or supply factors. (Hill, Tr. at 1706-08; PX5004 at 023 (¶ 48) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

356. Dr. Shehadeh's partial correlation analysis only controls for factors that might influence costs and seasonality; it does not address common demand shocks. (RX0170 at 0109 (¶ 200) (Shehadeh Report) (*in camera*)).

357. Dr. Shehadeh's cointegration analysis relies on a statistical test that research has shown requires orders of magnitude more observations than Dr. Shehadeh uses. (Hill, Tr. at 1709-1710; PX5004 at 023-24 (¶¶ 52-53) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

358. Dr. Shehadeh mistakenly justifies his use of cointegration analysis by citing to a paper that was published before the subsequent research showing the method's flaws. (Shehadeh, Tr. 3234-38).

359. For example, if one performs the same cointegration analysis used by Dr. Shehadeh, it would show that propane and crude oil are in the same market, but that is clearly erroneous. (PX5004 at 024-25 (¶ 55) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

ii. Dr. Shehadeh Misapplies the Hypothetical Monopolist Test in Defining the Relevant Geographic Market

360. Dr. Shehadeh criticizes Dr. Hill's implementation of the hypothetical monopolist test, saying that he wrongly includes potential supply in defining the hypothetical monopolist.

(Shehadeh, Tr. 3257-83). Dr. Shehadeh, however, is in error as his view contradicts the demand-centric approach laid out in the Horizontal Merger Guidelines; "Market definition focuses solely on demand substitution factors, i.e., on customers' ability and willingness to substitute away from one product to another in response to a price increase or a corresponding non-price change such as a reduction in product quality or service." (PX9085 at 007 (Horizontal Merger Guidelines, § 4)). Dr. Shehadeh also departs from the Horizontal Merger Guidelines' approach indicating that the hypothetical monopolist is "the only present and future seller of the relevant product(s) to customers in the region" and that "the terms of sale for products sold to all customers outside the region are held constant" in performing the market definition test. (PX9085 at 017-18 (Horizontal Merger Guidelines, § 4.2.2.); PX5004 at 034 (¶¶ 78-79) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

361. Rather than holding supply factors constant, Dr. Shehadeh argues that product sold outside the candidate market might be reallocated back to the candidate market in response to a SSNIP via either imports or a change in exports. (Shehadeh, Tr. 3258-85).

362. Dr. Shehadeh's consideration of changes to imports or exports as a form of arbitrage is inconsistent with all of the characterizations of arbitrage in the Horizontal Merger Guidelines. Whereas the Guidelines' examples only involve actions taken by consumers, Dr. Shehadeh's focus on exports and imports involves changes to the supply side of the market. (PX9085 at 010, 017-18 (Horizontal Merger Guidelines, §§ 4, 4.2.2.)).

363. Dr. Shehadeh claims that Dr. Hill's approach could result in Sandusky, Ohio being a relevant geographic market; however, Dr. Shehadeh overlooks one critical difference: unlike the customers of chloride TiO2 in North America at issue here, a customer in

Sandusky could likely engage in arbitrage by purchasing the product in Cleveland and delivering it to its plant in Sandusky. (Hill, Tr. 1732-33; PX5004 at 035 (¶¶ 81-82) (*in camera*)).

iii. Dr. Shehadeh Wrongly Criticizes Dr. Hill's Use of the North American Producer Price Index to Measure the TiO2 Price

364. Dr. Shehadeh criticizes Dr. Hill's analyses of imports into North America for using a "Producer Price Index" to account for the price in North America. (Shehadeh, Tr. 3268-72). Dr. Shehadeh argues that using this measure causes Dr. Hill to underestimate the responsiveness of imports to changes in the North American price. (Shehadeh, Tr. 3268-70).

365. Dr. Shehadeh's view is incorrect as Dr. Hill showed that he obtained a highly similar estimate of import responsiveness to that which he originally reported when he used Dr. Shehadeh's preferred measure of price. (PX5004 at 016 (¶ 34) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

366. Dr. Hill showed that Dr. Shehadeh's divergent estimates for import elasticity stem from his selection of a narrow time period and faulty econometric specification. (PX5004 at 014-20 (Section 2.B.1) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

367. Similarly, Dr. Hill also showed that he obtained estimates of the chloride TiO2 demand elasticity that were similar to—if not smaller than—his original estimates when he used Dr. Shehadeh's preferred measures of the domestic chloride price. (PX5004 at 012-13 (¶¶ 19-20) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

368. Dr. Hill's analysis indicates that Dr. Shehadeh's much larger estimates of the chloride elasticity stem from his faulty choice of dependent variable, which confounded missing

data with a change in price. (PX5004 at 010-13 (Section 2.A.1) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

iv. Dr. Shehadeh Errs in Criticizing Dr. Hill's Decision Not to Include the Sulfate TiO2 Price in His Chloride TiO2 Demand Regressions

369. Dr. Shehadeh criticizes Dr. Hill's import analyses for not separately including a measure of the sulfate price. (Shehadeh, Tr. 3300-01). Dr. Shehadeh suggests that omitting the sulfate price causes Dr. Hill to underestimate the sensitivity of North American consumers to changes in the chloride price. (Shehadeh, Tr. 3300-01).

370. Dr. Hill shows that this criticism is mistaken as Dr. Hill obtains estimates similar to – if not smaller than – his original calculations when he employs Dr. Shehadeh's preferred specifications but corrects the quantity demanded data series. (PX5004 at 012-13 (¶¶ 19-20) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

371. Consistent with these results, Dr. Hill showed visually that chloride TiO2's share of rutile sales was largely unrelated to its price premium relative to sulfate TiO2 and cited the views of many market participants as indicating that sulfate TiO2 was not a realistic substitute to chloride TiO2 for the vast majority of applications. (PX5000 at 041-49 (Sections 4.A.1 and 4.A.2) (Hill Initial Report) (*in camera*)).

v. Dr. Shehadeh Wrongly Characterizes the Extent of the Evidence Indicating Price Gaps Across Regions

372. Dr. Shehadeh states that he shows that there are not price gaps between North America and the rest of the world by looking just at {[redacted]} (Shehadeh, Tr. 3453-54 (*in camera*)).

373. Dr. Shehadeh's conclusions are incorrect. As Dr. Hill shows in his Rebuttal Report and its backup materials, analyses that control for customer and grade nevertheless show that the average price in North America was higher for a substantial period of time. (PX5004 at 073 (Appendix E) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

IV. MARKET STRUCTURE

A. The North American Chloride TiO2 Market Is Already Highly Concentrated

374. The market for sales of chloride TiO2 in North America is highly concentrated, and would become significantly more concentrated as a result of the Acquisition. (*See* CCFF ¶¶ 375-81, below).

i. There Are Five Major Producers in the Relevant Market

375. The North American chloride TiO2 market is {[redacted]} (Vanderpool, Tr. 185; Malichky, Tr. 313-14 (*in camera*); Christian, Tr. 817-18 (*in camera*); PX1230 at 019 (Tronox presentation) ({[redacted]}) (*in camera*)). These five producers account for over {[redacted]} of chloride TiO2 sales in North America. (PX5000 at 010, 067-68 (¶¶ 13, 152 & Fig. 25) (Hill Initial Report) (*in camera*)).

376. Tronox, Cristal, Chemours, Kronos, and Venator account for {[redacted]} of North America TiO2 production capacity. (PX5000 at 025-26 (¶ 59 & Fig. 9) (Hill Initial Report) (*in camera*)). All North American TiO2 production is chloride TiO2 with the exception of a small Kronos-owned sulfate TiO2 plant in Canada. (PX5000 at 025-26 (¶ 59 & Fig. 9) (Hill Initial Report) (*in camera*)).

377. Chemours, a DuPont spin-off, is currently the largest TiO2 producer in North America and globally. (PX9020 at 011 (Chemical Economics Handbook); PX9040 at 008 (Tronox investor presentation)). {[redacted]} (PX8004 at 001-02 (¶¶ 1, 6) (O'Sullivan Decl.) (*in camera*)). {[redacted]} (PX8004 at 002 (¶ 5) (O'Sullivan Decl.) ({[redacted]} (*in camera*)).

378. The two other major North American TiO2 companies—Kronos and Venator— jointly own a 50-50 joint venture that operates a chloride TiO2 plant in Lake Charles, Louisiana, with each company entitled to half of the facility's output. (PX8002 at 002 (¶ 7) (Christian Decl.) (*in camera*); PX8005 at 002 (¶ 10) (Maiter Decl.); Christian, Tr. 751-53). Outside of the United States, Kronos and Venator produce both chloride TiO2 (rutile) and sulfate TiO2 (rutile and anatase). (PX8002 at 002 (¶¶ 7-8) (Christian Decl.) (*in camera*); Christian, Tr. 751-52, 782; PX8005 at 002 (¶ 11) (Maiter Decl.)).

379. In addition to its one-half ownership of the Louisiana facility, Kronos has a TiO2 plant in Quebec, Canada and four plants in Europe. (PX8002 at 002 (¶¶ 7-8) (Christian Decl.) (*in camera*); Christian, Tr. 751-52). Kronos' Quebec facility consists of two plants—a chloride TiO2 plant and a small sulfate TiO2 plant. (Christian, Tr. 752). Kronos' sulfate plant in Quebec produces almost exclusively anatase TiO2 for food, pharmaceutical, and other niche applications. (Christian, Tr. 782). Kronos' overall TiO2 production capacity is 75% chloride TiO2 and 25% sulfate TiO2. (PX8002 at 002 (¶ 6) (Christian Decl.) (*in camera*); Christian, Tr. 749).

380. In addition to its one-half ownership of the Louisiana facility, Venator, a Huntsman spin-off, operates six TiO2 plants in Europe and one plant in Asia. (PX8005 at 001-02 (¶¶ 1, 9) (Maiter Decl.)). Other than the Louisiana facility, only one of Venator's plants makes chloride TiO2. (PX8005 at 002 (¶ 11) (Maiter Decl.)).

381. While Venator is one of the largest TiO2 companies in the world by capacity, its presence in North America is the smallest among the five major North American producers. (PX7015 (Maiter, Dep. at 60); PX8003 at 006 (¶ 26) (Young Decl.) (*in camera*); PX9040 at 008 (Tronox investor presentation)). Unlike the other four major North American producers, Venator does not have any TiO2 slurry capacity in North America. (PX7015 (Maiter, Dep. at 53-54, 60); Young, Tr. 660 (*in camera*); Pschaidt, Tr. 996 (*in camera*); Malichky, Tr. 609 (*in camera*)).

ii. Other Producers Have Minimal Chloride TiO2 Sales to North American Customers and Are Not Rapid Entrants

382. Outside of the five major producers, other producers have de minimis sales of chloride TiO2 in North America; those sales are included in the relevant market and account for a combined market share of less than **{ }**. (PX5000 at 067-68 (¶ 152 & Fig. 25) (Hill Report) (*in camera*)). Other than the five major producers, chloride TiO2 production is limited to a few Chinese producers, Ishihara in Japan, and KMML, a small producer in India. (PX1532 at 020 (TZMI Cost Study)). These other producers account for only of worldwide chloride TiO2 capacity. (PX5000 at 020-21 (¶ 49 & Fig. 3) (Hill Report) (*in camera*); PX1532 at 051 (TZMI Cost Study)).

383. The Horizontal Merger Guidelines consider firms that do not sell into the relevant market but who "would very likely provide rapid supply responses with direct competitive

impact in the event of a SSNIP" to be market participants because they are "rapid entrants." (PX9085 at 018-19 (Horizontal Merger Guidelines, § 5.1)). In that case, the Horizontal Merger Guidelines may consider calculating shares for those firms not based on actual sales in the relevant market, but based on capacities or reserves, but "only if a measure of their competitive significance properly comparable to that of current producers is available," and even then, "when market shares are measured based on firms' readily available capacities, the Agencies do not include capacity that is committed or so profitably employed outside the relevant market, or so high-cost, that it would not likely be used to respond to a SSNIP in the relevant market." (PX9085 at 018-19 (Horizontal Merger Guidelines, § 5.2.)).

384. The Chinese chloride TiO2 producers, Ishihara, and KMML do not meet this "rapid entrants" standard under the Horizontal Merger Guidelines because they could not "easily and rapidly" begin selling a meaningful amount of chloride TiO2 to customers in North America, they are not "very likely [to] provide rapid supply responses with direct competitive impact in the event of a SSNIP," and they do not have "readily available" capacity to supply significant volumes of chloride TiO2 to North America. (PX9085 at 018-19 (Horizontal Merger Guidelines, § 5.1); *see* CCFF ¶¶ 385-89, below).

385. Although a few Chinese manufacturers have chloride TiO2 production capacity, chloride TiO2 from Chinese producers does not have a meaningful competitive presence in North America. (*See* CCFF ¶¶ 747-807, below; PX7037 (Pickett, Dep. at 57-59) ({[redacted]}) (*in camera*); PX7052 (O'Sullivan, Dep. at 174) ({[redacted]

[redacted]

[redacted]**}**) (*in camera*)).

386. For the reasons described in CCFF Section VI, below, Chinese producers of chloride TiO2 are not rapid entrants or poised to expand their sales of chloride TiO2 in North America. Chinese chloride TiO2 producers have faced numerous problems, including: (1) being plagued by low production rates; (2) increasing manufacturing costs due to environmental regulations and higher feedstock prices; (3) limited available capacity due to growing demand for chloride TiO2 in China and throughout Asia; and (4) the quality of the chloride TiO2 they produce has been unacceptable to customers in North America for anything but small volume, low-end applications. (*See* CCFF ¶¶ 748-807). These firms therefore could not "easily and rapidly" sell significant volumes of chloride TiO2 into North America, they do not "clearly possess the necessary assets to supply into the relevant market," and they do not have "readily available" capacity to supply North America. (PX9085 at 019 (Horizontal Merger Guidelines, § 5.1)).

387. Ishihara has a single small-scale chloride TiO2 plant in Japan and sells about **{**[redacted]**}** of chloride TiO2 annually in North America, most of which are specialized premium grades. (PX3049 (Ishihara table) (*in camera*); PX3050 (Ishihara table) (*in camera*); PX3051 (Ishihara table) (*in camera*); PX7028 (Duenwald, Dep. at 51, 122) (**{**[redacted]**}**) (*in camera*)). **{**[redacted]**}** (PX1012 at 065 (Tronox TiO2 Strategic Plan 2017) (**{**[redacted]**}**) (*in camera*); PX1532 at 083

(TZMI Cost Study)). Ishihara therefore does not "clearly possess the necessary assets to supply into the relevant market," nor do they have "efficient" or "readily available" capacity to supply North America. (PX9085 at 019 (Horizontal Merger Guidelines, § 5.1)).

388. KMML is a small producer of chloride TiO2 in India that is reported to have an annual capacity of 40,000 tonnes. (PX1532 at 151 (TZMI Cost Study)). According to TZMI, KMML is one the world's highest cost producers of chloride TiO2. (PX1532 at 083 (TZMI Cost Study)). Tronox reports that India is one of the **{** **}**, which limits the availability of KMML's small-scale production for export. (PX1012 at 065 (Tronox TiO2 Strategic Plan 2017) (*in camera*)). As a small, high cost producer of TiO2, in a region with fast growing demand, KMML therefore is not a "rapid entrant" into the North American market for TiO2. (PX9085 at 019 (Horizontal Merger Guidelines, § 5.1)).

389. With manufacturing facilities located outside of North America, the Chinese chloride TiO2 producers, Ishihara, and KMML would incur duties and additional shipping costs relative to the five major producers who produce TiO2 in North America. (PX7028 (Duenwald, Dep. at 89-90) (**{** **}**) (*in camera*); *see also* PX7035 (Christian, Dep. at 77-78) (**{** **}**) (*in camera*)).

In addition to the reasons set forth above (*see* CCFF ¶¶ 386-88), this further demonstrates that the other chloride TiO2 producers will not "very likely provide rapid supply responses with direct competitive impact in the event of a SSNIP." (PX9085 at 018 (Horizontal Merger Guidelines, § 5.1)).

B. The Merger Significantly Increases Concentration in an Already Concentrated Market and Is Presumptively Anticompetitive

390. The federal antitrust agencies, consistent with the Horizontal Merger Guidelines and the courts, measure concentration using the Herfindahl-Hirschman Index ("HHI"). (PX9085 at 021 (Horizontal Merger Guidelines, § 5.3)). The HHI is calculated by totaling the squares of the market shares of each firm in the relevant market. (PX9085 at 022 (Horizontal Merger Guidelines, § 5.3)). Under the Merger Guidelines, a merger is presumed likely to create or enhance market power—and is presumptively illegal—when the post-merger HHI exceeds 2,500 and the merger increases the HHI by more than 200 points. (PX9085 at 022 (Horizontal Merger Guidelines, § 5.3)).

391. Post-acquisition, the combined firm would have a market share of **{ }** of sales of chloride TiO2 in North America. (PX5000 at 067-68 (¶ 152 & Fig. 25) (Hill Initial Report) (*in camera*)). The Proposed Acquisition would leave the merged firm and Chemours in control of **{ }**% of North American chloride TiO2 sales and over **{ }**% of North American chloride TiO2 capacity. (PX5000 at 067-68 (¶ 152 & Fig. 25) (Hill Initial Report) (*in camera*); PX5000 at 25-26 (¶ 59 & Fig. 9) (Hill Initial Report) (listing capacity of North American TiO2 plants) (*in camera*)).

392. The only other producers with meaningful post-acquisition market shares would be Kronos with **{ }**% and Venator with **{ }**%. (PX5000 at 067-68 (¶ 152 & Fig. 25) (Hill

Initial Report) (*in camera*)). Other producers would have a combined market share of less than {[redacted]}%. (PX5000 at 067-68 (¶ 152 & Fig. 25) (Hill Initial Report) (*in camera*)).

393. The Proposed Acquisition would increase the HHI by over 700 points, to over 3000. (PX5000 at 067-68 (¶¶ 152-53 & Fig. 25) (Hill Initial Report) (*in camera*)). The Proposed Acquisition is presumptively illegal and is likely to enhance market power in the North American chloride TiO2 market under the Horizontal Merger Guidelines because the HHI increases by more than 200 points and the post-acquisition HHI exceeds 2,500. (PX9085 at 022 (Horizontal Merger Guidelines, § 5.3); PX5000 at 068 (¶ 153) (Hill Initial Report) (*in camera*)).

C. The Merger Is Presumptively Anticompetitive Even in a North American Rutile TiO2 Market

394. Even in a market of all sales of rutile TiO2 in North America, the Proposed Acquisition is presumptively anticompetitive. Tronox, Cristal, Chemours, Kronos, and Venator, account for over {[redacted]}% of all rutile TiO2 sales in North America. (PX5000 at 133 (¶ 294, Fig. 42) (Hill Report) (*in camera*)).

395. Beyond these five major producers, there are regional manufacturers of TiO2, primarily located in {[redacted]} (PX1000 at 012 (Tronox 2016 presentation) (*in camera*); PX7025 (Malichky, Dep. at 64-65) (*in camera*)). These fringe manufacturers have minimal sales in the relevant market and are not "rapid entrants" under the Horizontal Merger Guidelines because they are not "very likely [to] provide rapid supply responses with direct competitive impact in the event of a SSNIP." (PX9085 at 018-19 (Horizontal Merger Guidelines, § 5.1)). {[redacted]}

[redacted] **}** (PX8002 at 004 (¶ 19) (Christian Decl.) (*in camera*); PX8004 at 002-03 (¶ 9) (O'Sullivan Decl.) (*in camera*); PX8003 at 003 (¶ 14) (Young Decl.) (*in camera*)).

396. Outside of the five major producers, the other TiO2 producers do not have a meaningful competitive presence in the market for rutile TiO2 sales in North America; their sales, which are included in the relevant market, amount to a combined share of only **{[redacted]}.** (PX5000 at 133 (Fig. 42) (Hill Initial Report) (*in camera*); PX3034 at 001 (Venator email) ("The Chinese producers account for less than 6% of North American and European share. The major impact on price competition is from the four other major TiO2 producers."); PX9006 at 006 (Tronox Q2 2015 Earnings Call) ("We do not see that exports from China or from Europe are playing a material role in the competitive balance, particularly in the North American market."); PX7015 (Maiter, Dep. at 204) ("We do not go head-to-head with [Chinese] producers in those two markets, in Europe and North America."); Christian, Tr. 810-11 ({[redacted]}) (*in camera*); PX7052 (O'Sullivan, Dep. at 174) ({[redacted]}) (*in camera*)).

397. Post-acquisition, the combined firm would have a market share of **{[redacted]}**% in a market for all rutile TiO2 sales in North America, and the combined firm and Chemours would control **{[redacted]}**% of the market. (PX5000 at 133 (¶ 294 & Fig. 42) (Hill Report) (*in camera*)). The Proposed Acquisition would increase the HHI by more than 550 and

result in a highly concentrated market with an HHI of 2,528. (PX5000 at 133 (¶ 295 & Fig. 42) (Hill Report)). Therefore, the Proposed Acquisition is presumptively anticompetitive even in a market of all rutile TiO2 sales in North America. (Hill, Tr. 1756; PX9085 at 022 (Horizontal Merger Guidelines, § 5.3)).

V. ANTICOMPETITIVE EFFECTS

A. The Merger Would Make the Relevant Market More Vulnerable to Coordinated Interaction

398. "[T]he Merger Guidelines consider coordination to be when the actions taken by a firm are only profitable because of the accommodating actions of its rivals." (Hill, Tr. 1798; PX9085 at 027 (Horizontal Merger Guidelines, § 7)). Coordination can take different forms. Coordination can be "an explicit agreement that [firms] will not compete for one another's customers and, hence, be able to charge higher prices." (Hill, Tr. 1798-99). Coordination can also be tacit, in which firms learn over time that they should not steal each other's customers but there is no explicit agreement between them. (Hill, Tr. 1799; PX5000 at 091 (¶¶ 210-11) (Hill Initial Report) (*in camera*); PX9085 at 027 (Horizontal Merger Guidelines, § 7)). Situations can also arise in which "a firm realizes one of its rivals has become less aggressive and so itself charges a higher price." (Hill, Tr. 1799; PX9085 at 027-28 (Horizontal Merger Guidelines, § 7)).

399. Applying the Horizontal Merger Guidelines, Dr. Hill concluded that the merger is likely to increase the probability of coordinated interaction in the market for the sale of chloride TiO2 in North America. (Hill, Tr. 1799, 1818; PX5000 at 069 (¶¶ 157-58) (Hill Initial Report) (*in camera*)).

400. As Dr. Hill testified, the Horizontal Merger Guidelines set out three steps in determining whether a merger will increase the likelihood of coordinated effects. (PX9085 at 028 (Horizontal Merger Guidelines, § 7.1)). The first step is to determine whether the market post-merger will be highly concentrated and the merger will significantly change that concentration. The second step is to examine whether the market today is susceptible to coordinated interaction. The final step is to find out whether the merger would increase the susceptibility of the market to coordinated behavior. (Hill, Tr. 1799-1800; PX5000 at 091-92 (¶ 213) (Hill Initial Report) (*in camera*); PX9085 at 028 (Horizontal Merger Guidelines, § 7.1)).

401. In determining whether a market is susceptible to coordination, several factors are considered such as: (1) mutual awareness among firms of their shared interest, (2) the number of firms in the market is small, (3) the products in the market are homogenous, (4) firms can and do monitor one another's behavior, (5) the price elasticity of demand is low, and (6) there is a past history of actual or attempted coordination among firms. (Hill, Tr. 1800-01; PX5000 at 092 (¶ 215) (Hill Initial Report) (*in camera*)). Dr. Hill examined each of these factors and found that the chloride TiO2 market in North America is already vulnerable to coordination. (Hill, Tr. 1801; PX5000 at 92 (¶ 215) (Hill Initial Report) (*in camera*); PX9085 at 028-30 (Horizontal Merger Guidelines, § 7.2)).

402. Dr. Hill concluded that there are three significant ways in which the merger will make the North American market for chloride TiO2 more susceptible to coordination. First, it will reduce the complexity of coordination among the firms in the market. Second, it will increase transparency. Third, it will replace a firm, Cristal, that in the past had

aggressively competed with a firm, Tronox, that does not compete as aggressively. (Hill, Tr. 1809-10; PX5000 at 106 (¶247) (Hill Initial Report) ({ [redacted] }) (*in camera*)).

i. The North American Chloride TiO2 Market Is Already Vulnerable to Coordination

(a) The number of firms in the relevant market is small

403. The North American market for chloride TiO2 is highly concentrated and the merger will significantly increase that concentration. (Hill, Tr. 1800). As Dr. Hill concluded in his expert report, "[c]oordination is more likely to occur when the number of firms who must be involved for it to be effective is smaller. Coordination of any kind involves communication, and the larger the number of involved firms, the greater the possibility for misunderstandings. Thus, the smaller is the number of firms, the easier it typically is to coordinate." (PX5000 at 096 (¶ 219) (Hill Initial Report) (*in camera*)).

404. There are five major producers of chloride TiO2 in North America: Tronox, Cristal, Chemours, Kronos, and Venator, which together account for over 99% of chloride TiO2 sales in North America. (Hill, Tr. 1804). The acquisition of Cristal by Tronox will reduce the number of major producers of chloride TiO2 in North America from five to four. Post-merger two firms would control 73% to 75% of the North American chloride TiO2 market. (Hill, Tr. 1804; *see* CCFF, *supra*, section IV. Market Structure).

(b) North American chloride TiO2 producers recognize their mutual interdependence

405. Based on his review of the record, Dr. Hill observed that producers in the relevant market exhibit mutual interdependence: "Reviewing information from the parties and from third parties, I concluded that firms in this industry are well aware that their actions affect one another, that they are mutually interdependent." (Hill, Tr. 1801; PX9085 at 027 (Horizontal Merger Guidelines, § 7) ("Coordinated interaction involves conduct by multiple firms that is profitable for each of them only as a result of the accommodating reactions of the others. These reactions can blunt a firm's incentive to offer customers better deals by undercutting the extent to which such a move would win business away from rivals."); PX5000 at 092-96 (¶¶ 216-18) (Hill Initial Report) (*in camera*)).

406. Tronox and Cristal's internal planning documents illustrate the high level of recognized mutual interdependence that Dr. Hill observed. (*See* CCFF ¶¶ 407-09, below).

407. For example, Tronox's five-year TiO2 strategy plan update from August 2016 states: {[redacted]} (PX1004 at 015 (Tronox TiO2 Strategy and 5-Year Plan Update, Aug. 2016) (*in camera*); PX1036 at 017 (Tronox TiO2 Strategy and 5-Year Plan Update, Aug. 2016) ({[redacted]}) (*in camera*)).

408. In an internal email summarizing a call among Tronox executives, Mr. Engle, a Tronox vice president, discussed {[redacted]} (PX1024 at 001 (Engle email to Staton and Smith) (*in camera*)).

409. Similarly, a Cristal sales and marketing presentation from August 2016 states: {[redacted]} (PX2116 at 061 (Cristal Sales and Marketing Program, Aug. 2016) (*in camera*)).

410. The parties' TiO2 competitors also recognize the mutual interdependence of TiO2 producers, noting the need for industry "discipline" and the negative price effects that follow aggressive competition for business in their earnings calls and industry conference remarks. (PX9075 at 004 (Huntsman [Venator] Q2 2016 Earnings Call) ("We continue to be disciplined with our sales volumes in an effort to maximize the effective capture of the announced TiO2 price increase."); PX9075 at 014 (Huntsman [Venator] Q2 2016 Earnings Call) ("I see greater pricing discipline taking place in TiO2."); PX9025 at 003 (Chemours at Goldman Sachs Basic Materials Conference Transcript) ("Now, reflecting on the dynamics of the past, we at Chemours conclude that our own response to market dynamics was a contributor to the volatility that we experienced in our business performance. And we've decided to take a more meaningful approach to the TiO2 market.")).

411. Finally, in reviewing information from the parties and from third parties, Dr. Hill concluded that: "firms in this industry are well aware that their actions affect one another, that they are mutually interdependent." (Hill, Tr. 1801, 1833 (partially *in camera*)).

(1) North American chloride TiO2 producers' price increase efforts are highly interdependent

412. Tronox has developed its TiO2 pricing strategy around this mutual interdependence. (*See* CCFF ¶¶ 413-19, below.) In a 2016 Board of Directors presentation discussing the Tronox price increase implementation process, Mr. Romano, Tronox's Chief Commercial Officer, explained how **{** [redacted] **}** (PX1021 at 002 (Romano email to Turgeon) (*in camera*); PX7001 (Romano, IHT at 143) (**{** [redacted] **}**) (*in camera*)).

413. The presentation by Mr. Romano described **{** [redacted] **}** (PX1021 at 002 (Romano email to Turgeon) (*in camera*)). Mr. Romano also described **{** [redacted] **}** (PX1021 at 002 (Romano email to Turgeon) (*in camera*)).

414. Mr. Romano testified in his investigational hearing to **{** [redacted] **}** (PX7001 (Romano, IHT at 158-59) (*in camera*)).

415. Further, Mr. Romano described **{** [redacted] **}** (PX7001 (Romano, IHT at 138) (**{** [redacted] **}**) (*in camera*)).

416. Mr. Romano and other Tronox and Cristal executives testified extensively that [redacted] (PX7001 (Romano, IHT at 214) (**{** [redacted] **}**) (*in camera*); PX7001 (Romano, IHT at 223) (**{** [redacted]

[redacted]**}**) (*in camera*); Romano, Tr. 2156-57 (*in camera*); PX7002 (Mouland, IHT at 77) ({[redacted]**}**) (*in camera*); PX7026 (Duvekot, Dep. at 52) ({[redacted]**}**) (*in camera*); PX7043 (Gigou, Dep. at 31-33) ({[redacted]**}**) (*in camera*)).

417. When Chemours announced a price increase of $150 per metric ton on December 17, 2015, **{**[redacted]**}** (PX1046 at 002 (Casey email to Romano and Grebey) (*in camera*)).

418. The next day, in an email to Tronox's Board members, **{**[redacted]**}** (PX1047 at 001 (Casey email to Tronox Board members) (*in camera*)).

419. In the same email to Tronox's Board members following the December price increase announcement, Mr. Casey explained: {[redacted]} (PX1047 at 001 (Casey email to Tronox Board members) (*in camera*)).

420. From Cristal's perspective, the December 2015 price increase announcements were {[redacted]} (PX2055 at 022 (Cristal presentation) (*in camera*)). {[redacted]} (PX2216 at 001 (Nahas email to VanValkenburgh) (*in camera*)).

421. On the same day Tronox announced its price increase in December 2015, a Cristal executive anticipated in an internal email that other TiO2 producers would follow Tronox's increase: "Tronox follows the trend. Tronox also[] announces global increase of US$150/tonne for all TiO2 grades, effective Jan. 1, 2016, or as contracts allow. Expectedly, other TiO2 manufacturer's [sic] may follow the trend. We would be keen to observe market acceptance of these price increase announcements in Q1 2016. It's an initiative to taste [sic] the market readiness to accept this announced price increase." (PX2035 at 002 (Cristal email)). Shortly after, another Cristal executive confirmed that Huntsman [Venator] also announced its price increase. (PX2035 at 001 (Cristal email)).

422. Numerous other Tronox and Cristal internal documents demonstrate this interdependent pricing of TiO2. (*See* CCFF ¶¶ 423-26, below). For example, a Tronox weekly regional

sales report for Americas from May 2016 reports that **{** [redacted] **}** (PX1163 at 001 (Tronox Americas weekly report) (*in camera*); PX7002 (Mouland, IHT at 74-75) (*in camera*)).

423. In a 2017 email, Mr. Mouland, a Tronox sales vice president, requested **{** [redacted] **}** (PX1093 (Mouland email to Romano) (*in camera*); PX1201 (Mouland email to Romano) ({ [redacted] **}**) (*in camera*); Mouland, Tr. 1156-58 (*in camera*); *see also* PX1212 at 003 (January 2017 Price Approval Request regarding a plastics customer, {[redacted]**}**) ({ [redacted] **}**) (*in camera*)).

424. In an email to Cristal's Chairman, Cristal's sales vice president at the time observed that: "In current market conditions of excessive inventory we cannot raise price and gain market share at the same time unless all suppliers support the price movement. If we see other such public price announcement information for other suppliers in the coming days, we will then assess whether or not we want to also make a price announcement and if market dynamics can support such an initiative." (PX2087 at 002 (Stoll email to Al-Shair)).

425. In October 2016, following a publically announced price increase by a competitor, Mr. Gigou, Cristal's sales vice president, wrote of the announced price increase to other Cristal senior executives: **{** [redacted] **}**, to which Mr. Gunther, Cristal's head of TiO2 business, responded **{** [redacted] **}** (PX2007 at 001 (Gigou email to Gunther) (*in camera*)).

426. Further, the major North American chloride TiO2 producers over the years have increased TiO2 prices typically in close proximity to each other in time. (PX1204 (December 2016 Tronox Excel spreadsheets **{** [redacted] **}**) (*in camera*); Pschaidt, Tr. 975 ("Usually the TiO2 manufacturers announce price increases very close to each other, so it normally is announced within a short period of time of each other."); Malichky, Tr. 328, 332 (**{** [redacted] **}**) (*in camera*); PX8003 at 006 (¶ 29) (Young Decl.); PX8001 at 003 (¶ 17) (Zamac Decl.) (*in camera*); *see also* PX7025 (Malichky, Dep. at 80) (**{** [redacted] **}**) (*in camera*)).

(2) North American chloride TiO2 producers' production decisions are highly interdependent

427. Tronox and Cristal documents indicate that companies make TiO2 production decisions for the purpose of supporting higher TiO2 prices. (*See* CCFF ¶¶ 428-32, below). For

example, in early 2016, {[redacted]}, Mr. Duvekot of Tronox explained that {[redacted]} Mr. Duvekot further explained that {[redacted]} (PX1435 at 001 (Duvekot email) (*in camera*); Duvekot, Tr. 1333-35 (*in camera*)).

428. In fact, what Mr. Duvekot explained is what, in early 2015, Tronox's Mr. Casey had projected would happen: "It is our view that an upward move in pigment selling prices will be predicated on a reduction of supply in the pigment market relative to demand and/or upward move in feedstock selling prices and we expect to see both." (PX9007 at 005 (Tronox Q1 2015 Earnings Call); Arndt, Tr. 1363-64).

429. A few months later, in Tronox's 2015 third quarter earnings call, Mr. Casey disclosed that Tronox had idled a portion of its TiO2 production, emphasizing the impact of this decision on pricing, and emphasizing how Tronox observed other TiO2 producers "acting in the same way": "And the question is, when will [the prices] turn? We're addressing that by managing our production so that inventories get reduced to normal or below normal levels. And when that happens, prices will rise. We -- from what we see with Chemours and Huntsman and presumably others as well, they're doing the same thing. We see them acting in the same way." (PX9005 at 010 (Tronox Q3 2015 Earnings Call)).

430. In 2015, shortly after Mr. Casey had publically stated that Tronox had idled part of its Hamilton plant, {[redacted]

[redacted] **}** (PX2055 at 024 (Cristal presentation) (*in camera*)). And Tronox cheered these developments as "Good news!!" with Tronox's then-CEO Mr. Casey remarking "[i]t's good that [Chemours] can follow the leader!" (PX1325 (Casey email to the Tronox senior executive team)).

431. Cristal also has observed there to be discipline in TiO2 producers' decisions to reduce TiO2 capacity. In a September 2011 email, Cristal's Mr. Stoll wrote: "The pricing momentum began when significant major capacity was taken off line in 2008 and 2009 during the Financial Crisis. More than 300,000mt came off-line in this period, including Le Havre and Hawkins Point. . . . The markets went from a very over-supplied situation for many years to a more balanced to tight scenario where growth then started to exceed supply. This discipline of taking supply off-line and allowing inventories to fall as demand improved lead [sic] to pricing discipline and pricing power over the following quarters. . . . However, over the next several months we are going to really see if the industry can maintain market discipline as global demand stalls going into a seasonally low period." (PX2083 at 001 (Stoll email to Najjar)).

432. Cristal's emphasis on adjusting TiO2 production to limit competition is long-standing. As described in a strategic plan review for 2006, the company's strategy at that time was to match production to sales, and part of this was to "[c]urtail production in a down market (don't use price to push volume)." (PX2024 at 013 (Lyondell, Cristal's predecessor, Inorganics 2006 LRP Review); PX6005 at 020 (Lyondell 2007 LRP Plans) ({[redacted]}) (*in camera*)).

(c) The mutually recognized interdependence among North American TiO2 producers is reflected in their efforts to maintain "discipline" and avoid triggering competitive responses

433. Tronox and Cristal documents repeatedly demonstrate mutually accommodating conduct by chloride TiO2 producers with the intention to support market discipline. (*See* CCFF ¶¶ 434-41, below). As Mr. Casey has publicly described: "As you saw, we have not gained market share by trying to reduce price. We don't think that's the appropriate strategy going forward . . . ." (PX9010 at 005 (Tronox Q2 2014 Earnings Call)).

434. For example, when Mr. Casey asked Mr. Romano in 2011 to explain **{** [redacted] **}** (PX1090 at 001 (Romano email to Casey) (*in camera*)).

435. In a similar July 2012 email, Mr. Romano wrote to Mr. Casey, then-CEO of Tronox and Mr. Greenwell, then-CFO that: **{** [redacted]

[redacted] } (PX1015 at 001 (Romano email to Casey and Greenwell) (*in camera*); Romano, Tr. 2161-63 (*in camera*)).

436. In that same email to Mr. Casey and Mr. Greenwell, Mr. Romano explained [redacted] } (PX1015 at 001 (Romano email to Casey and Greenwell) (*in camera*); Romano, Tr. 2163-64 (*in camera*)).

437. Not only did Mr. Romano make this point to Mr. Casey several times in 2011 and 2012, but so did Mr. Wayne Hinman, a member of the Tronox Board of Directors: { [redacted] } (PX1075 at 001 (Hinman email to Casey) (*in camera*)).

438. Similar to the observation by Mr. Romano, an October 2011 presentation by Cristal's Mr. Stoll to Cristal's Steering Body illustrates that Cristal's view at that time on reducing price was in line with Tronox's: "The ***'Evil Sin'*** would be to attempt to lower prices to take market share as markets weaken. ***We Must Hold Price!***" (PX2242 at 017 (Cristal Steering Body Meeting Commercial Update) (emphasis in original); Stoll, Tr. 2086; PX7009 (Stoll, Dep. at 146-47) (*in camera*)).

439. A couple months later, in December 2011, Mr. Stoll informed Mr. Nahas, Cristal's then-President, that { [redacted]

[redacted]

[redacted] (PX6000 at 003 (Stoll email to Nahas) (*in camera*)).

440. [redacted] (PX2247 at 155-56 (*Valspar v. Millennium Inorganic Chemicals et al. multidistrict price fixing litigation,* Deposition Transcript of Mark Stoll) (*in camera*)).

441. Similarly, Mr. Stoll was asked during the Maryland price fixing litigation about an internal 2007 memo from Cristal's John Hall, which had the following guidance relating to TiO2 price**:** [redacted] (PX6023 at 002 (Hall email to Stoll and others) (*in camera*)). [redacted]

[redacted]**}**) (PX2245 at 048 (*In Re: Titanium Dioxide Antitrust Litigation*, Deposition Transcript of Mark Stoll) (*in camera*)).

442. In addition, examples of individual pricing decisions, as detailed below, reflect the efforts on the part of both Tronox and Cristal to maintain pricing in the period of large-scale price increases that began around 2010. (*See* CCFF ¶¶ 443-47, below; *see also* PX2083 at 001 (Stoll email to Najjar) (*in camera*)).

443. In a July 2011 email, responding to a sales manager's request for a price to quote for a prospective customer **{**[redacted]**}**, Mr. Mouland provided guidance on [redacted] **{**[redacted] **}** (PX1291 at 001 (Mouland email to Larson) (*in camera*)).

444. In an August 2011 email, a Tronox sales manager reported to Mr. Mouland on his discussions at **{**[redacted] **}** (PX1292 at 001-02 (Email exchange between Mouland and Larson) (*in camera*)).

445. In May 2011, Cristal had a potential business opportunity at **{**[redacted]

[redacted] **}** (PX2021 at 001-02 (Email exchange between Herrmann, Jaquet, and others) (*in camera*)).

446. In August 2011, Tronox's Mr. Mouland asked Mr. Romano for a **{** [redacted] **}** (PX1095 at 001 (Mouland email to Romano) (*in camera*)).

447. Despite Mr. Mouland's observations in August 2011 that **{** [redacted] **}** (PX1096 at 002 (Tronox Americas weekly report, Sept. 28, 2011) (*in camera*)).

448. Based on his review of the period from 2010 to 2012, Dr. Hill in fact concluded that **{** [redacted] **}** (PX5004 at 056-57 (¶¶ 147-49 & Fig. 24) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

449. As demand waned in the period after 2012, [redacted]. (*See* CCFF ¶¶ 450-59, below).

450. For example, in a 2014 presentation regarding Tronox's sales and marketing strategy, [redacted] (PX1016 at 062 (Tronox presentation) ([redacted]) (*in camera*)).

451. During the second half of 2014, Tronox had an opportunity to secure new business at [redacted] (PX1086 at 002-03 (Romano email to Duvekot, Mouland, and Doherty) (*in camera*)). [redacted] (PX1076 at 001 (Doherty email to Mouland) (*in camera*)).

452. Similarly, Tronox's Mr. Duvekot recommended for a sales and marketing presentation that Tronox focus on [redacted] (PX1360 at 001

(Duvekot email to Romano) (*in camera*); PX7026 (Duvekot, Dep. at 111-12) ({ [redacted] }) (*in camera*); *see also* PX1030 at 013 (Tronox presentation) ({ [redacted] }) (*in camera*)).

453. When Mr. Duvekot was asked in his deposition { [redacted] } (PX7026 (Duvekot, Dep. at 101-02) (*in camera*)).

454. In April 2015, responding to an email [redacted] wrote: { [redacted] } (PX1453 at 001 (Duvekot email to Mouland) (*in camera*); PX7026 (Duvekot, Dep. at 119-21) (*in camera*); *see also* PX1429 at 001 (Duvekot email to Bruno) ({ [redacted] }) (*in camera*)).

455. In July 2015, Mr. Duvekot reiterated { [redacted] }, in an email discussing { [redacted] }

[redacted] **}** (PX1432 at 001 (Duvekot email to Hofman) (*in camera*); PX7026 (Duvekot, Dep. at 125-27) (*in camera*); *see also* Duvekot, Tr. 1330 **({** [redacted] **}) (in** *camera*)).

456. In August 2015, Mr. Romano, Tronox's Chief Commercial Officer, wrote while approving a price request from a sales manager: **{** [redacted] **}** (PX1133 at 001 (Romano email to Bradley) (*in camera*)).

457. In a March 2016 email, Tronox's Mr. Mouland wrote to two salespeople: **{** [redacted] **}** (PX1305 at 001 (Mouland email) (*in camera*); PX7022 (Mouland, Dep. at 70-71) (*in camera*)).

458. In November 2016, one of its distributors in the United States asked Tronox about **{** [redacted]

[redacted] } (PX1077 at 001 (Mouland email) (*in camera*)).

459. Further, Tronox's 2017 Strategic Plan, dated June 2016, captures the approach that Tronox has developed to {[redacted]}: {[redacted] } (PX1091 at 016 (Tronox TiO2 Strategic Plan 2017) (*in camera*); *see also* Romano, Tr. 2163 ({[redacted]}) (*in camera*); PX9010 at 005 (Tronox Q2 2014 Earnings Call) ("As you saw, we have not gained market share by trying to reduce price. We don't think that's the appropriate strategy going forward . . . .")).

(d) TiO2 producers are able to observe each other's competitive actions; i.e., the relevant market is transparent

460. "A market typically is more vulnerable to coordinated conduct if each competitively important firm's significant competitive initiatives can be promptly and confidently observed by that firm's rivals." (PX9085 at 029 (Horizontal Merger Guidelines, § 7.2)). The North American chloride TiO2 market exhibits the kind of competitive transparency that facilitates coordination by allowing "significant competitive initiatives" of rival firms to "be promptly and confidently observed by that firm's rivals." (PX9085 at 029 (Horizontal Merger Guidelines, § 7.2); PX5000 at 096 (¶ 221) (Hill Initial Report) (*in camera*); Hill, Tr. 1804-05).

461. TiO2 producers routinely develop detailed information about competitive initiatives by other producers and anticipate competitive responses. They accomplish this through public price announcements, statements made in earnings calls, investor presentations,

and industry conferences, and from customers. (*See* CCFF ¶¶ 462-92, below). After reviewing the evidence, Dr. Hill concluded that "[s]uch transparency" as seen in the North American chloride TiO2 market "can result in coordination and higher prices." (PX5000 at 099 (¶ 229) (Hill Initial Report) (*in camera*)).

(1) TiO2 producers gather competitive intelligence from each other's public disclosures

462. Earnings calls provide a means for TiO2 producers to communicate with respect to pricing and other competitive initiatives. (*See* CCFF ¶¶ 463-74, below; Hill, Tr. 1805 ("[T]here are numerous examples in documents from producers in which they monitor one another's earnings calls and one another's 10-Ks, when available. So that's one source of information."); Malichky, Tr. 329 ({ }) (*in camera*); PX7025 (Malichky, Dep. at 86) ("It's just -- it's something that's very unique to TiO2.")). As Tronox's Mr. Arndt, Vice President of Investor Relations, testified at trial, Tronox's public statements to investors, including earnings calls, are made on behalf of Tronox as a whole and that the company uses its best efforts to ensure that its statements to investors are accurate, complete, and not misleading. (Arndt, Tr. 1359).

463. As publicly-traded companies whose primary business line is TiO2, the major TiO2 producers in their earnings calls provide detailed information regarding their expectations for production, their inventory situations, and their plans and expectations for pricing, information, which makes the competitive environment more predictable, and serves to allow other producers the information to "promptly and confidently" assess competitive

initiatives of these other producers. (PX9085 at 029 (Horizontal Merger Guidelines, § 7.2); Arndt, Tr. 1360-61 (When discussing its quarterly results, Tronox discusses changes in sales volume, margin information, and operation related information such as plant utilization rate and inventory levels); PX5000 at 096-97 (¶¶ 222-23) (Hill Initial Report) (companies often provide considerable detail during earnings calls regarding competitively sensitive topics, including both their pricing and production plans.) (*in camera*)). Based on his review of the evidence, Dr. Hill concluded that the public statements of other chloride TiO2 suppliers show that they recognize that capacity and pricing decisions affect all of the firms in the industry. (PX5000 at 095 (¶ 218) (Hill Initial Report) (*in camera*)).

464. Tronox and Cristal monitor and analyze public statements by rivals such as quarterly earnings updates, presentations at industry conferences, and ratings agency meetings. (PX7002 (Mouland, IHT at 33-34) ({[redacted]}) (*in camera*); PX1039 at 004 (Merturi email to Staton and Arndt) ({[redacted]}) (*in camera*); PX1052 at 001-02 (McGuire email to Tronox sales executives) (containing notes from November 2016 Chemours earnings call, citing to Chemours outlook of reduced inventories and stronger price environment); PX1053 at 001-03 (Arndt email to Tronox senior executives) (attaching August 2016 Chemours earnings call transcript projecting continuing price increases through 2016, and discussing

Chemours inventory situation); Romano, Tr. 2142-44; PX1054 at 001-04 (Engle email to Romano, Duvekot, Mouland) (describing "tidbits" from Huntsman transcript relating to inventories and utilization); PX2051 at 001 (Stoll email to Nahas) ("It is interesting being here at the TZMI Conference this week in Hong Kong. There is much concern by all of the TiO2 producers about the price collapse and how much lower pricing will go.")).

465. Tronox's Mr. Engle, vice president of marketing, listens to competitor's earnings calls to learn about their production plans and other announcements, and obtain competitive intelligence. (Engle, Tr. 2540-41; Engle, Tr. 2482 ("So the biggest source [of competitive intelligence] would be trade data and public filings or public announcements, investor presentations, things like that.")). Following the calls, Mr. Engle creates write-ups that include information about price increases and circulates them to other Tronox executives. (PX1051 at 001-02 (Engle email to Romano, Duvekot, Mouland) (attaching a Huntsman investor call transcript discussing announced price increase for Europe where Huntsman emphasized how it was "prepared to walk away from volumes in some cases and so forth" and how the increase "will be the first of I think multiple initiatives."); PX7001 (Romano, IHT at 182-86) (*in camera*)).

466. In early 2016, in response to an analyst question about an announced TiO2 price increase, Chemours CEO, Mark Vergnano, reiterated Chemours' view that "we really need to drive this price increase" even though "if you are just purely looking at this as an operating rate situation[,] you might come to a different conclusion." (PX9048 at 008 (Chemours Q4 2015 Earnings Call)). Then, in a 2016 earnings call, Mr. Vergnano of Chemours projected price increases that would continue through 2016: "Yes, I think as you look at the rest of the year, you'll see a cadence up in our price as you look at third quarter . .

. . [S]o we feel good about where we are on the price side, and I think you will see continued movement because of the execution of these price increases for the rest of the year." (PX9056 at 009 (Chemours Q2 2016 Earnings Call)). Tronox's Mr. Romano described the information from this earnings call to be a **{** **}** (PX7001 (Romano, IHT at 194-96) (*in camera*)).

467. Likewise, Huntsman (now Venator) provides information about their pricing approach for TiO2. At a basic materials conference sponsored by Goldman Sachs, Huntsman's Executive Vice President stated: "Well, there's the April 1 effective price increase. It was roughly $235 a ton, nominated. And we have communicated and signaled that we would expect the realization on that price would be on the upper end of what we've been realizing over the last 3 or 4 quarters. That is closer to 2/3, 70% realization." (PX9060 at 003 (Huntsman Corp at Goldman Sachs Basic Materials Conference Transcript)). And from Huntsman's Q2 2016 Earnings Call, Tronox's head of investor relations, Mr. Arndt, highlighted the statement "We continue to be disciplined with our sales volumes in an effort to maximize the effective capture of the announced TiO2 price increase" in his summary of the call, which he circulated to senior Tronox executives. (PX1055 at 001 (Arndt email to Tronox senior executives)).

468. **{** **}** (PX2059 at 002-10 (Cristal competitor earnings call analysis, Nov. 2016) (*in camera*); PX2060 at 002-13 (Cristal competitor earnings call analysis, Aug. 2016) (*in camera*); PX2061 at 001-16 (Cristal competitor earnings call analysis, Mar. 2017) (*in*

camera); PX2062 at 001-15 (Cristal competitor earnings call analysis, May 2017) (*in camera*); PX2278 at 004-14 (Cristal competitor profitability analysis, Mar. 2013)).

469. Cristal considers the investor calls of TiO2 competitors meaningful enough that key executives listen to the calls, and the company distributes summaries of the calls. (PX2049 at 001-04 (Stoll email to Trabzuni) ({ }) (*in camera*); PX2268 at 001 (Cristal email relating to Tronox and Chemours 2016 earnings calls with "Key Messages" relating to projected pricing, low inventories, and motivation for price increases during 2017); PX2269 at 001 (Cristal email relating to competitor earnings results describing, among other things, lower capacity utilization rates); PX2361 at 002-04 (Verrett email to Cristal senior executives) (summarizing key comments from competitors' earnings calls on price increase announcements and implementation, inventory levels, plant utilization rates, and expectations for future pricing)).

470. Like other TiO2 producers, Tronox's public disclosures include competitive information such as margin information, sales information, plant utilization rate and inventory information. (Arndt, Tr. 1361, 1369-70).

471. During its Q1 2015 earnings call, Tronox described its approach to TiO2 production decisions with an emphasis on the forward looking steps it was taking to support higher TiO2 pricing. Specifically, Mr. Casey, Tronox's then-Chairman and CEO projected the company's expectation of reduced supply of TiO2 that would lead to increased pricing: "It is our view that an upward move in pigment selling prices will be predicated on a reduction of supply in the pigment market relative to demand and/or upward move in

feedstock selling prices and we expect to see both." (PX9007 at 005 (Tronox Q1 2015 Earnings Call)). Shortly after the Q1 2015 earnings call, Tronox publicly announced its decision to reduce production at two of its TiO2 pigment plants, Hamilton and Kwinana. (PX9006 at 003 (Tronox Q2 2015 Earnings Call) ("Production has been suspended at one of our six processing lines in Hamilton and one of our four processing lines at Kwinana, both of which are pigment plants. Together, these processing line curtailments represent approximately 15% of total pigment production.")).

472. In Tronox's Q3 2015 earnings call, after reducing production at two TiO2 pigment plants, Mr. Casey described how Tronox was addressing the question "when the prices turn" by "managing our production," and added an observation about Tronox's TiO2 competitors: "And then the question is, when will they turn? We're addressing that by managing our production, so that inventories get reduced to normal or below normal levels. And when that happens, prices will rise. We -- from what we see with Chemours and Huntsman and presumably the others as well, they're doing the same thing. We see them acting in the same way." (PX9005 at 010 (Tronox Q3 2015 Earnings Call); *see also* PX9005 at 002 (Tronox Q3 2015 Earnings Call) ("Industry supply and demand will return to balance. The obvious question is, when? And I can't tell you that because I can't speak for the industry as a whole. However, I can tell you that we are reducing our inventory, freeing up working capital, generating cash, and accelerating the return to supply-demand balance. From their public announcements, we believe others at both the feedstock and the pigment levels are doing the same thing. So, we're optimistic about the return to a more normal market conditions in TiO2.")).

473. In its Q1 2016 earnings call, Mr. Casey followed up by emphasizing Tronox would seek to manage production at its Hamilton plant in a disciplined manner: "We believe that a very disciplined approach to production, to managing supply relative to demand, is what has facilitated the recovery in our markets, and we intend to continue to be disciplined about that. So, we don't intend to bring back the full production instantaneously simply because we see the very first signs of price recovery." (PX9003 at 010 (Tronox Q1 2016 Earnings Call)).

474. Further, in its Q1 2016 earnings call, Tronox also discussed actions taken by other producers to reduce TiO2 output: "I can tell you that I thought last year Huntsman, I believe Cristal, Chemours, and we all lowered our plant utilization rates, and we all talked about declining inventories which we had set as a goal. That is that we wanted to reduce inventories. Clearly, the way that one reduces inventories is one reduces production and continues to maintain sales, which is what we all tried to do." (PX9003 at 008 (Q1 2016 Tronox Earnings Call)).

475. Dr. Shehadeh was asked in several different instances at trial whether he had even considered public disclosures of Tronox, and he admitted that he had not. (Shehadeh, Tr. 3584-85 ("Q. You didn't rely on PX 9001 for your opinions in this case, did you, Dr. Shehadeh? A. I did not." (quoting Tronox's Mr. Casey in PX9001 at 009 ["So the question for us is, do we confront China-produced supply in the market as a competitive alternative to our supply? And as I've said, we don't."]); *see also* Shehadeh, Tr. 3540-41 (did not consider PX9007, Q1 2015 Tronox Earnings Call); Shehadeh, Tr. 3541-42 (did not consider PX9003 (Q1 2016 Tronox Earnings Call); Shehadeh, Tr. 3543-44 (did not

consider PX9005, Q3 2015 Tronox Earnings Call); Shehadeh, Tr. 3562-63 (did not consider PX9008, Q4 2014 Tronox Earnings Call)).

(2) TiO2 producers gather competitive pricing information

476. Tronox and Cristal sales representatives obtain **{** **}** (Romano, Tr. 2154-55; *see* CCFF ¶¶ 477-88, below). **{** **}** (PX2368 at 001-05 (Cristal North America Weekly Report) (*in camera*); Mouland, Tr. 1145-46; PX7001 (Romano, IHT at 155-56) (*in camera*)). **{** **}** (Mouland, Tr. 1155-56 (*in camera*)).

477. This competitive intelligence is obtained from **{** **}** (PX2068 at 001 (Weeks email to Snider and Gigou) (*in camera*); PX2069 at 003 (Cristal Price Decision Form) (*in camera*); PX1050 at 001 (Mouland email to Romano) (describing pricing **{** **}**) (*in camera*); PX2070 at 001-03 (Parks email to Clover) (*in camera*)).

478. In many instances, **{** **}** (PX1048 at 001-02 (Duvekot email to Romano) ({ **}**) (*in camera*); Duvekot, Tr. 1311-13 (*in camera*); PX1089 (Doherty email to Mouland) ({

[redacted]

[redacted]

[redacted]

[redacted]}) (*in camera*); PX1088 at 001 (Mouland email to Romano) (information provided by {[redacted]

[redacted]

[redacted]

[redacted]**}**) (*in camera*); PX1211 at 001 (Mouland email to Doherty and Wills) (discussing three customers where **{**[redacted]

[redacted]**}**) (*in camera*); PX1741 at 001 (Mouland email to Romano) (Tronox's Mr. Mouland seeking a price approval for a customer while citing **{**[redacted]

[redacted]

[redacted]**}**) (*in camera*); PX1157 at 001 (Mouland email to Duvekot) (describing specific prices offered to a customer **{**[redacted]

[redacted]**}**) (*in camera*); PX1735 at 002 (Tronox Americas Weekly Report) (describing that **{**[redacted]

[redacted]**}**) (*in camera*)).

479. Tronox's **{**[redacted]**}** describes how its sales representatives **{**[redacted]

[redacted]**}** (PX1021 at 002 (Romano email to Turgeon) (*in camera*); PX7046 (Romano, Dep. at 89-90, 102) (*in camera*)).

480. As Tronox's Mr. Romano acknowledged, Tronox does a {[redacted]} (PX7001 (Romano, IHT at 171) (*in camera*); PX7046 (Romano, Dep at 89-90) (*in camera*)). {[redacted]} (PX7046 (Romano, Dep. at 85-86) (*in camera*)).

481. As Tronox's Mr. Mouland, a vice president of sales, explained, {[redacted]} (PX7002 (Mouland, IHT at 13-14); PX7002 (Mouland, IHT at 84) (discussing {[redacted]}) (*in camera*); PX7022 (Mouland, Dep. at 58) ({[redacted]}) (*in camera*)).

482. In one email exchange, a Tronox sales manager {[redacted]} (PX1434 at 001-02 (Bondt email) (instructing a sales agent to {[redacted]} and urging the salesperson to {[redacted]}) (emphasis in original) (*in camera*)).

483. Cristal's contemporaneous business documents likewise demonstrate [redacted] (PX2065 at 001 (Florville email to Parks) ({[redacted]}

[redacted]

[redacted]

[redacted]**}**) (*in camera*); PX2068 at 001 (Weeks email to Snider and Gigou) ([redacted]

[redacted]

[redacted]}) (*in camera*)).

484. As Cristal's Mr. Stoll confirmed during an investigational hearing, **{**[redacted]

[redacted]

[redacted]

[redacted]**}** (PX7006 (Stoll, IHT at 188) (*in camera*)).

485. For example, **{**[redacted]

[redacted]**}** (PX7037 (Pickett, Dep. at 50) (*in camera*)). This information in turn is included in **{**[redacted]

[redacted]**}** (PX7037 (Pickett, Dep. at 93) (*in camera*); PX7043 (Gigou, Dep. at 75-77) (*in camera*)).

486. Further, Cristal's **{**[redacted]

[redacted]**}** that the major TiO2 firms are able to collect. (PX2316 at 002-03 ([redacted]

[redacted]**}**) (*in camera*)).

{[redacted]

[redacted]**}** (PX7010 (Snider, Dep. at 61-62, 66) (*in camera*); PX7009 (Stoll, Dep. at 164) ([redacted]

[redacted]

[redacted] }) (*in camera*)).

487. Cristal's **{** [redacted] **}** (PX7010 (Snider, Dep. at 33-34) (*in camera*)). Much of the market intelligence **{** [redacted] **}** (PX7009 (Stoll, Dep. at 165) (*in camera*)).

488. **{** [redacted] **}** Dr. Hill found that **{** [redacted] }. (Hill, Tr. 1833-35 (*in camera*); PX5000 at 098-99 (¶ 228 & Fig 35) (Hill Initial Report) (*in camera*)).

489. Other TiO2 producers also describe obtaining competitive information from customers. For example, Kronos obtains competitive intelligence from customers and the information is a data point that Kronos considers when making business decisions. (Christian, Tr. 756-57). Chemours [redacted] **}** (PX7052 (O'Sullivan, Dep. at 31-32) (*in camera*)).

490. Finally, **{** [redacted]

[redacted] (*See* CCFF ¶¶ 491-92, below).

491. In April 2016, Tronox's Mr. Grobler summarized what he had learned following an April 2016 conference call with [redacted] (PX1178 at 002 (Grobler email to Romano) (*in camera*); PX7001 (Romano, IHT at 198) (*in camera*)).

492. Again, in June and August 2016, Mr. Grobler reported to Mr. Romano summarizing what Tronox learned from June/August 2016 teleconferences with [redacted] (PX1187 at 002 (Grobler email to Romano) (*in camera*); PX1306 at 002 (Gerhard email to Romano) (*in camera*); PX1307 at 001 (Gerhard email to Romano) (*in camera*)).

(e) Products in the North American chloride TiO2 market are relatively homogenous

493. Tronox documents and testimony describe [redacted] (PX1004 at 015 (Tronox presentation) ([redacted]) (*in camera*); PX0016 at 026 (Tronox White Paper) (*in camera*); PX7014 (Quinn, Dep. at 38) (*in camera*); PX7041 (Veazey, IHT at 46) (*in camera*); PX7036 (Keegel, Dep. at 110) (*in camera*) ([redacted]).

494. [redacted] (PX7052 (O'Sullivan, Dep. at 31-32) (*in camera*)). Moreover, [redacted]

[redacted] **}** (PX7052 (O'Sullivan, Dep. at 29) (*in camera*)).

495. **{**[redacted]**}** (*see* CCFF ¶¶ 748-54, below), **{**[redacted]**}** (PX8000 at 002 (¶ 8) (Malichky Decl.) (*in camera*); Young, Tr. 659-60 (*in camera*); PX8003 at 001-02 (¶ 5) (Young Decl.) (*in camera*); PX7030 (Arrowood, Dep. at 8-9)). Therefore, **{**[redacted]**}** (Romano, Tr. 2155-56 (*in camera*)).

496. As Akzo Nobel's Mr. Post testified, **{**[redacted]**}** (PX7033 (Post, Dep. at 79) (*in camera*)). Mr. Post also observed that the **{**[redacted]**}** (PX7033 (Post, Dep. at 97) (*in camera*)).

497. After reviewing the quantitative and qualitative evidence, Dr. Hill concluded that **{**[redacted]**}** (PX5000 at 096 (¶ 220) (Hill Initial Report) (*in camera*); Hill, Tr. 1803).

(f) The price elasticity of demand for chloride TiO2 in North America is low

498. Price elasticity of demand is how responsive demand is to changes in price. Inelastic demand makes a market more susceptible to coordination because if prices of all firms

were to rise, few sales would be lost, which makes the reward or coordinating greater. (Hill, Tr. 1803-04).

499. After conducting quantitative analysis, Dr. Hill concluded that the price elasticity of demand for chloride TiO2 in North America is low. (Hill, Tr. 1803). As detailed in Appendix C.2 of his initial expert report, Dr. Hill calculated that demand for chloride TiO2 in North America is highly inelastic. (Hill, Tr. 1803-04; PX5000 at 051-052, 099 (¶¶ 113, 230) (Hill Initial Report) (*in camera*)).

ii. The Merger Would Likely Enhance That Vulnerability and Facilitate Future Coordination

500. Following the Horizontal Merger Guidelines analysis, Dr. Hill concluded that a merger of Tronox and Cristal would increase the likelihood of coordination in the North American market for chloride TiO2. The merger will reduce the complexity of coordination, increase transparency between industry players and remove a firm in Cristal with a stated plan to compete more vigorously. (PX5000 at 101 (¶ 235) (Hill Initial Report) (*in camera*); Hill, Tr. 1758-59, 1809-10).

(a) Eliminating a firm makes coordination easier for the remaining firms in a market

501. Dr. Hill, following the Horizontal Merger Guidelines analysis, concluded that the merger would simplify coordination by eliminating a current competitor while also creating a new firm of a similar size to Chemours, the current market leader. (PX5000 at 101 (¶ 236) (Hill Initial Report) (*in camera*); Hill, Tr. 1809-11) ("Q. And what is your basis for the determination that the merger will reduce the complexity of coordination? A. So I think there are two essential bases. The first is it will reduce the number of firms from

five to four, which reduces the complexity of particularly tacit but also potentially explicit coordination.").

(b) The merger would eliminate the impact of competition from Cristal

502. The merger will not merely remove a competitor, but, in Cristal, a competitor intent on trying to grow its share of the North American chloride TiO2 market with lower prices in recent years. (*See* CCFF ¶¶ 503-05, below).

503. In November 2014, when Tronox's Mr. Casey was describing how Tronox was not interested in reducing price to gain share, Cristal was taking a different approach. As Cristal's Mark Stoll described in an email to his colleague Richard Gillette, Cristal at that time was "lowering price to try to get market share and move more tonnes." (PX2037 at 002 (Stoll email to Gillette)).

504. Cristal has been particularly focused on growing share [redacted] {[redacted] } (PX2025 at 007 (Cristal presentation) (*in camera*); PX7000 (Snider, IHT at 87-88) (*in camera*);; PX2041 at 010 (Cristal 2016 Marketing Strategy) (emphasis for North America is {[redacted]}) (*in camera*); PX2040 at 003 (Cristal Presentation) ("big challenge and top priority is to increase the N. America market share"); PX7037 (Pickett, Dep. at 67-68) ({[redacted]}) (*in camera*)). In a separate presentation in June 2015, Cristal announced {[redacted]

[redacted]**}** (PX2046 at 013 (Cristal Presentation) (*in camera*); PX2289 at 052 (Cristal presentation) (describing goal to [redacted]**}**) (*in camera*)).

505. In September 2016, Mr. Gigou, Cristal's vice president of sales, told the company's sales managers: {[redacted]} (PX2027 at 001 (Gigou email) (*in camera*)). Cristal's Brian Pickett responded that **{**[redacted]**}** (PX2219 at 001 (Pickett email) (*in camera*)).

506. Following the adoption of that strategy, Cristal has on numerous occasions aggressively pursued business in North America. (*See* CCFF ¶¶ 507-25, below).

507. In late 2016, Cristal approached {[redacted]} (PX4120 at 002 (PPG Presentation) (*in camera*); PX7025 (Malichky, Dep. at 306) (testifying that {[redacted]**}**) (*in camera*)). Ultimately, Cristal {[redacted]**}** (PX7037 (Pickett, Dep. at 71) (*in camera*)).

508. Also, Sherwin Williams {[redacted]} (Young, Tr. 690-91 (*in camera*)).

509. In March 2015 when Cristal obtained its first order from Benjamin Moore, Cristal's Mr. Gigou reported that "we have finally managed to break through at Benjamin Moore, one

of the largest and most respectful [sic] coatings account in North America." To this news, Jamal Nahas, Cristal's then-President, responded: "This is great & will increase our market share in America as planned." (PX2233 at 001-02 (Gigou email to Van Valkenburgh)).

510. {[redacted]} (PX2275 at 009, 019 (Jaquet email attaching Ashtabula update) ({[redacted]}) (*in camera*)).

511. Cristal's commercial team anticipated that Cristal's effort to recover market share would impact pricing. In an email from John Hall to Mark Stoll and others he wrote: "At the next Steering Body Meeting on May21st we will debate and agree on a specific action plan – we believe the current plan is to run the assets hard, recover some share, accept that price will go down." (PX2241 at 001 (Hall email to Cristal senior executives)).

512. In an email to Mr. Nahas, Cristal's then-President, Mr. Stoll noted that "I want to assure you we have moved to an offensive position. This will put more downward pressure on pricing in some regions in the coming weeks, but we will re-gain our market share and cash flow." (PX2232 at 003 (Stoll email to Nahas)).

513. Finally, in an email to his colleagues, Cristal's Mr. Gigou wrote, "[i]t is clearly understood that we'll have to go for volume and that is what we have already initiated. As per our recent discussion, we can't go for price and volume . . . ." (PX2265 at 001 (Gigou email to Snider and VanValkenburgh)).

514. Tronox documents reflect the impact that Cristal's effort had on its own pricing decisions. In an Americas Weekly Report written by Mr. Mouland to Mr. Duvekot in April 2014, Mr. Mouland writes that **{** [redacted] **}** (PX1308 at 002 (Tronox Americas Weekly Report) (*in camera*)).

515. In late 2015, Tronox sales representative Mr. Doherty reported to Mr. Mouland that **{** [redacted] **}** (PX1146 at 001 (Doherty email to Mouland) (*in camera*)).

516. Again in late 2015, Tronox was forced to reduce its price to { [redacted] } (PX1363 at 001 (Mouland email forwarding report) (*in camera*)).

517. In October 2012, Tronox's Mr. Duvekot approved **{** [redacted] **}** (PX1368 at 001-02 (Duvekot email to Mouland) (*in camera*)).

518. In February 2016, Cristal offered **{** [redacted]

[redacted] (PX1037 at 001 (Mouland email) (*in camera*); PX7002 (Mouland, IHT at 185-86) (*in camera*)).

519. In December 2016, it was reported to Tronox that [redacted] (PX1300 at 001 (Mouland email to Newman) (*in camera*); *see also* Mouland, Tr. 1199 ([redacted]) (*in camera*)).

520. In March 2017, Tronox sales representative Stan Newman relayed to Ian Mouland information describing Tronox's [redacted] (PX1364 at 001-03 (Newman email) (*in camera*)).

521. In a 2015 email to Mr. Mouland, Mr. Larson explains that [redacted] (PX1309 at 001) (Larson email to Mouland) (*in camera*)).

522. In January 2015, Tronox's Mr. Mouland wrote to others at Tronox that [redacted]. (PX1310 at 001 (Mouland email) (*in camera*)).

523. In a Tronox call report describing conversations and meetings with {[redacted]} in 2014, Terry Doherty wrote that [redacted] with not only {[redacted]} {[redacted]} [redacted] (PX1302 at 001 (Tronox call report) (*in camera*); Mouland, Tr. 1195-98 (*in camera*)).

524. [redacted] For example, a Huntsman document from 2016, **{**[redacted]**}** (PX3028 at 008 (Huntsman Presentation) (*in camera*)).

525. [redacted] **{**[redacted]**}** (PX8003 at 007 (¶ 34) (Young Decl.) (*in camera*); Young, Tr. 690-91 (*in camera*)).

526. Dr. Hill concluded that [redacted] **}** (PX5000 at 103-04 (¶ 242) (Hill Initial Report) (*in camera*)).

527. Further, **{**[redacted]**}** including the documents and statements around its decision [redacted] (PX1435 at 001 (Duvekot email) ({[redacted]

[redacted]**}**) (*in camera*); *see more generally* Tronox's continuing emphasis on [redacted] CCFF ¶¶ 528-35, below).

528. An array of documents reflect that Tronox approach. In a 2013 email, Mr. Duvekot wrote: **{**[redacted]**}** (PX1430 at 001 (Duvekot email) (*in camera*); Duvekot, Tr. 1326-27 (*in camera*); PX7026 (Duvekot, Dep. at 109) (*in camera*)). In a 2015 email, Mr. Duvekot wrote to Mr. Mouland that **{**[redacted]**}** (PX1448 at 001 (Duvekot email to Mouland) (*in camera*)).

529. When prospective customers have asked **{**[redacted]**}** In an email discussing **{**[redacted]**}** Mr. Romano noted that **{**[redacted]**}** (PX1158 at 001 (Mouland email) (*in camera*); PX7002 (Mouland, IHT at 189-92) (*in camera*)). When {[redacted]**}** (RX0445 at 0001 (Mouland email) (*in camera*)).

530. In a July 2015 email exchange, Mr. Duvekot reminded Mr. Mouland that Tronox was continuing to **{** [redacted] } (RX0271 at 0001-02 (Mouland/Duvekot email chain) (*in camera*)).

531. The July 2015 email was similar to an email that Mr. Duvekot had sent the Tronox's regional sales managers in June 2015. (RX0434 at 0001-02 (Duvekot email) (**{** [redacted] **}**) (*in camera*)).

532. In a 2014 email relating to **{** [redacted] **}** (PX1098 at 001 (Mouland email to Romano) (*in camera*)). Mr. Mouland made a similar observation on pricing activity during 2015: **{** [redacted]

[redacted] (PX1018 at 004 (Mouland performance review) (*in camera*)); PX7002 (Mouland, IHT at 111-13) (*in camera*)). In a February 2017 email, Mr. Mouland wrote [redacted] (PX1215 at 008 (Mouland email to Romano) (*in camera*); PX7002 (Mouland, IHT at 118-19) (*in camera*)).

533. In February 2017, [redacted] In a follow up email about [redacted] (PX1099 at 001 (Email exchange between Mouland and Romano) (*in camera*)).

534. Finally, in March 2017, Mr. Mouland wrote to a Tronox sales manager, Adrian Santos, responding to a call report Mr. Santos had written about a meeting with a potential customer, [redacted] which included not only [redacted] Mr.

Mouland responded that: **{** [redacted] **}** (PX1038 at 001-02 (Mouland email to Santos) (*in camera*); Mouland, Tr. 1200-02 (*in camera*)).

535. Tronox's relative pricing is not lost on customers. For example, **{** [redacted] **}** wrote to Terry Doherty of Tronox: **{** [redacted] **}** (PX1332 at 001 (Doherty email to Mouland) (*in camera*)).

536. Dr. Hill described the concern associated with the combination of **{** [redacted] **}** (PX5000 at 106 (¶ 247) (Hill Initial Report) (**{** [redacted] **}**) (*in camera*)).

(c) The merger would increase transparency among North American chloride TiO2 producers

537. The major TiO2 producers such as Tronox, Chemours, Kronos, and Venator are publically traded companies. All are essentially "pure play" TiO2 producers, which serves to make investor calls and presentations particularly productive sources of information. (Hill, Tr. 1810-11; *see* CCFF ¶¶ 462-74, above).

538. In 2015, Chemours was spun off from DuPont and became its own publically traded company. (PX7052 (O'Sullivan, Dep. at 13) (*in camera*)). In 2017, Venator was spun

off from Huntsman and became its own publicly traded company. (PX8005 at 001 (¶ 1) (Maiter Decl.)).

539. The recent spinoffs of Chemours from DuPont and Venator from Huntsman have increased the ability to monitor and communicate with rivals using public statements and earnings calls because prior to the spinoffs, disaggregated information on TiO2 was typically not available in the financial reports of DuPont and Huntsman. Cristal's Mark Stoll testified to this fact in his Investigational Hearing: {[redacted]} (PX7006 (Stoll, IHT at 119-21) (*in camera*); PX3000 at 003 (Venator Presentation) (*in camera*)).

540. In 2015, Huntsman told investors during an investor conference, that having more publically traded TiO2 companies will "[a]bsolutely" change the dynamics of the market. (PX9041 at 004 (Basic Materials Conference Transcript)).

541. In a June 2017 investor presentation, Venator explained that {[redacted]} (PX3000 at 004 (Venator presentation) (*in camera*)). This statement suggests that {[redacted]}

[redacted]**}** (PX3000 at 004 (Venator presentation) (*in camera*); PX5000 at 95 (¶ 218) (Hill Initial Report) (*in camera*)).

542. A week later at its Analyst Day presentation Venator again **{**[redacted]**}** (PX3054 at 094 (Venator presentation) (*in camera*).

543. In a September 2017 presentation to investors, Kronos highlighted "Industry Consolidation and Recent Independence of Leading [chloride TiO2] Players." Kronos went further noting "Improving Ti02 focus across [the] industry" meaning a greater percentage of each firms business was tied to Ti02 than it had been in the past, before the spinoffs of Venator and Chemours and the proposed merger of Tronox and Cristal. (PX3011 at 020 (Kronos investor presentation)).

544. As more TiO2 suppliers have become pure play TiO2 companies, their earnings calls will focus more on TiO2 than they have in the past, when the companies had other unrelated businesses. Also, the more pure play TiO2 suppliers need to carefully run their businesses because they are not diversified or assisted with cash from other businesses and the benefits of a larger organization with possibly better technical services. (Christian, Tr. 769-71).

(d) The merger would result in greater symmetry between the merged firm and Chemours, making it easier to coordinate

545. As discussed in CCFF ¶ 391, above, the merger will result in a new firm similar in size to Chemours. Dr. Hill concluded that in the current market structure, Chemours is in a

fundamentally different position than Tronox, Cristal, Kronos and Venator because it is more sensitive to changes in the market price than its smaller rivals are because it is a lot bigger than they are. The merger will change that as the merged Tronox and Cristal will be similar in size to Chemours. (PX5000 at 101 (¶ 236) (Hill Initial Report) (*in camera*); Hill, Tr. 1810).

546. In 2017, Chemours has shared publically its plans to implement a TiO2 strategy to capture more value for TiO2 across a range of applications. At an industry conference Chemours stated: "Now, reflecting on the dynamics of the past, we at Chemours conclude that our own response to market dynamics was a contributor to the volatility that we experienced in our business performance. And we've decided to take a more meaningful approach to the TiO2 market." (PX9025 at 003-04 (Goldman Sachs Basic Materials Conference transcript)).

547. According to Tronox's Mr. Arndt, "analysts now view [Tronox] as a price leader along with DuPont [Chemours], based on [their] respective low cost positions, something [Tronox] [have] been stressing with the investment community." (PX1143 at 001 (Arndt email); PX7007 (Van Niekerk, IHT at 199-200) ({[redacted]}) (*in camera*)).

548. Dr. Hill also concluded that pre-merger, tacit coordination among Chemours, Tronox and Cristal would be more challenging because Cristal and Tronox are significantly smaller than Chemours, which means that the two smaller firms would have different incentives than the much larger Chemours. Post-transaction those incentives would be aligned. (PX5000 at 101 (¶ 238) (Hill Initial Report) (*in camera*); Hill, Tr. 1816-18).

549. Dr. Hill concluded that in the long run, Chemours and post-merger Tronox would have increased incentive to pursue higher profits by coordinating and lowering their production volumes. (Hill, Tr. 1996-97). Dr. Hill used his model, which represents one possible way tacit coordination could occur, and analyzed whether the firms might have increased incentive to engage in coordination. (Hill, Tr. 1998-99; PX5000 at 101 (¶ 237) (Hill Initial Report) (*in camera*)).

550. Dr. Hill also concluded that the combined firm would have less of an incentive to pursue a North American expansion plan than Cristal alone because the combined firm will be more than twice Cristal's size and therefore more sensitive to changes in the market price. In other words, it will value more highly maintaining or raising the market price than increasing its share. (PX5000 at 104 (¶ 245) (Hill Initial Report) (*in camera*)).

B. The Merger Would Increase Tronox's Incentive to Unilaterally Reduce Output

551. The merger will likely result in unilateral anticompetitive effects. Basic economic principles and the evidence in the record—ordinary course documents, testimony, and econometric work—uniformly show that industry participants, including the Respondents, already recognize that withholding chloride TiO2 output from the North American market results in higher prices. This evidence also shows that the merged firm, with its "larger base of sales on which to benefit from the resulting price rise" would have a greater incentive to withhold output from the market than the stand-alone firms do today. (PX9085 at 026 (Horizontal Merger Guidelines, § 6.3); *see* CCFF ¶¶ 552-694, below).

i. The Merger Guidelines Recognize that Mergers Like This One May Lead to Output Suppression

552. The Merger Guidelines recognize that "[i]n markets involving relatively undifferentiated products" a merged firm may "find it profitable unilaterally to suppress output and elevate the market price. A firm may leave capacity idle, refrain from building or obtaining capacity that would have been obtained absent the merger, or eliminate pre-existing production capabilities." (PX9085 at 025-26 (Horizontal Merger Guidelines, § 6.3)).

553. Industry participants consistently recognize that **{** **}**. (PX0016 at 26 (Oct. 2017 Tronox White Paper) (*in camera*) ({ }); PX7014 (Quinn, Dep. at 38) (*in camera*) ({ }); PX7036 (Keegel, Dep. at 110) (*in camera*) ({ }); PX2250 at 028 (*In Re: Titanium Dioxide Antitrust Litigation*, Deposition Transcript of Bart de Jong) (*in camera*); *see also* CCFF ¶¶ 493-97).

554. **{** **}** (Young, Tr. 688 (*in camera*); Pschaidt, Tr. 974-75; Hill, Tr. 1840 (*in camera*); PX2250 at 028 (*In Re: Titanium Dioxide Antitrust Litigation*, Deposition Transcript of Bart de Jong) (*in camera*)). If a firm reduces its output, all else being equal, the market price will increase. (PX5000 at 010 (¶ 16) (Hill Initial Report) (*in camera*)). **{** **}** (PX2247 (Stoll, Dep. at 043) (*in camera*)).

555. As explained by a past CEO of Millennium, Cristal's predecessor, {[redacted]} (PX2250 at 028-29, 050 (*In Re: Titanium Dioxide Antitrust Litigation*, Deposition Transcript of Bart de Jong) (*in camera*); Young, Tr. at 688 (*in camera*) ({[redacted]}); RX0069 at 043 ({[redacted]}) ({[redacted]}) (*in camera*); PX7033 (Post, Dep. at 121-22) (*in camera*) ({[redacted]}); PX7046 (Romano, Dep. at 181-182) (*in camera*) ({[redacted]})).

556. {[redacted]} (Arrowood, Tr. 1085-86 ("The other suppliers, Kronos, Huntsman/Venator and DuPont/Chemours, they won't send quotes. They don't reach out to me or Deceuninck . . . ."); PX8001 at 002 (Zamac Decl.) (¶6) (*in camera*); PX7025 (Malichky, Dep. at 170-72) (*in camera*); PX7030 (Arrowood, Dep. at 13) (*in camera*)). {[redacted]} (Young, Tr. 687-88 (*in camera*)).

557. As customers like PPG described at trial, {[redacted]} (Malichky, Tr. 330-31 (*in camera*); *see also* Pschaidt, Tr. 974 ("In my experience, what

happens when the -- the market gets -- when we call it too long or there's too much TiO2 in the marketplace, that then suppliers usually would reduce their production capacity to rein in and tighten the market up again.")).

558. Based on the fundamental economics of supply and demand, Dr. Hill shows that the benefit to a supplier of withholding output in a commodity market where supply largely determines price is that, due to the higher market price resulting from the reduced supply, the firm earns more profit per unit on the output that it continues to produce. (PX5000 at 073 (¶ 168) (Hill Initial Report) (*in camera*)).

559. Dr. Hill's economic analysis also shows that in an unconcentrated market with many firms, where each has a small market share, there is typically little incentive to withhold output because most of the benefit of that withholding would be captured by other firms. (PX5000 at 075 (¶ 176) (Hill Initial Report) (*in camera*)). As a firm's market share rises, however, the benefit it obtains from withholding its output increases. (PX5000 at 075 (¶ 176) (Hill Initial Report) (*in camera*)). As a result, a larger firm has a greater incentive to withhold output than a smaller one. (Hill, Tr. 1764-65, 1768-69).

560. As the Merger Guidelines recognize, a merger increases the incentives of a firm to unilaterally reduce output because the larger a firm's market share, the more it captures the benefits resulting from the withheld output. (PX9085 at 026 (Horizontal Merger Guidelines, § 6.3) ("a merger may provide the merged firm a larger base of sales on which to benefit from the resulting price."); PX5000 at 072-75 (§ 5.A.1) (Hill Initial Report) (*in camera*)).

561. Dr. Hill's analysis of the chloride TiO2 producers' invoice data shows that pre-merger, Cristal and Tronox account for **{** [redacted] **}** and **{** [redacted] **}** of chloride TiO2 sales in North

America, respectively. (PX5000 at 068 (¶ 152, Figure 25) (Hill Initial Report) (*in camera*)). The proposed merger would create a firm with a {[redacted]} market share, {[redacted]} in the benefit, and therefore, the incentives, of the merged firm to withhold output. (Hill, Tr. 1768-69 ("So roughly either of the stand-alone firms is being doubled in size, and that gives it greater incentive to withhold output than the stand-alone firms have."); PX5000 at 075 (¶ 177) (Hill Initial Report) (*in camera*)).

562. The Merger Guidelines recognize that a merged firm is especially likely to adopt an output withholding strategy "when (1) the merged firm's market share is relatively high; (2) the share of the merged firm's output already committed for sale at prices unaffected by the output suppression is relatively low; (3) the margin on the suppressed output is relatively low; (4) the supply responses of rivals are relatively small; and (5) the market elasticity of demand is relatively low." (PX9085 at 026 (Horizontal Merger Guidelines, § 6.3)). All of these conditions are met here. (*See* CCFF ¶¶ 563-67, below).

563. First, the merged firm will have a "relatively high" market share in a market for the sale of chloride titanium dioxide to North American customers. Post-merger, Tronox will be {[redacted]} of chloride TiO2 in North America with a market share exceeding {[redacted]}. This combined market share is {[redacted]} than stand-alone Tronox and Cristal's {[redacted]} and {[redacted]} market shares premerger, respectively. (PX5000 at 068 (¶152) (Hill Initial Report) (*in camera*); *see* CCFF ¶ 391, above).

564. Second, in the market for the sale of chloride TiO2 to North American customers, "[t]he share of the merged firm's output already committed for sale at prices unaffected by the output suppression is relatively low." (PX9085 at 026 (Horizontal Merger Guidelines, § 6.3)). {[redacted]}

[redacted]**}** (Romano, Tr. 2156-57 (*in camera*); Young, Tr. 687 (*in camera*); Pschaidt, Tr. 975; Stoll, Tr. 2095; PX7025 (Malichky, Dep. at 160) (*in camera*)). **{**[redacted]**}** (PX7002 (Mouland, IHT at 66-67) (*in camera*); PX7025 (Malichky, Dep. at 161) (*in camera*)). Because prices are short term, TiO2 sellers could quickly reap the benefits of a price increase resulting from reduced supply.

565. Third, an output withholding strategy would be profitable for the merged entity because the overall profit on the large amount of retained sales at the higher price resulting from the reduction in output would exceed the profits that would have been earned on the foregone sales. (PX5000 at 072-73, 87-88 (¶¶167-68, 199) (Hill Initial Report) (*in camera*)). Respondents' view of the North American chloride TiO2 market and the effect output reduction has on prices, along with the fact that Respondents have reduced output several times over the past decade, shows that they believe it would be profitable. (*See* CCFF ¶¶ 568-82, 586-630, below).

566. Fourth, the remaining North American chloride TiO2 suppliers are unlikely to increase their own output in North America to undercut the merged firm's efforts to raise prices through output reduction. If other North American chloride TiO2 suppliers would react by significantly increasing their supply in North America, that could render the merged firm's effort to raise prices unprofitable, but there is no evidence they would do so, rather the evidence is to the contrary. (*See, e.g.*, Hill, Tr. 1772-73; CCFF ¶¶ 583-85, 636-57, below).

567. Finally, consistent with the Merger Guidelines' factors, North American customer demand for chloride TiO2 is highly inelastic. (PX5000 at 051-52 (¶113) (Hill Initial Report) (*in camera*)). After conducting quantitative analysis, Dr. Hill found that North American customers are unlikely to substitute sulfate TiO2 or stop using TiO2 altogether even if prices for chloride TiO2 were to rise significantly. (Hill, Tr. 1692; PX5000 at 051 (¶ 113) (Hill Initial Report) (*in camera*)). Those results are consistent with the comments and behavior of chloride TiO2 producers and customers. (*See* CCFF ¶¶ 111-33, above).

ii. TiO2 Producers Recognize that Withholding Chloride TiO2 Output Supports Higher Prices

(a) Tronox's public statements and internal correspondence demonstrate that the company recognizes that withholding chloride TiO2 output supports higher prices

568. Given this market context where prices are largely determined by supply and demand, it is not surprising that the Respondents and other chloride TiO2 suppliers recognize the benefits of strategically withholding chloride TiO2 output in North America to increase prices relative to what otherwise would have prevailed. (*See* CCFF ¶¶ 569-85, below).

569. Tronox has made repeated public statements that it withholds chloride TiO2 from the North American market to affect price. (PX9003 at 010-11 (Tronox Q1 2016 Earnings Call); PX9005 at 009-10 (Tronox Q3 2015 Earnings Call); PX9007 at 005 (Tronox Q2 2015 Earnings Call)).

570. For example, in a 2015 earnings call, Mr. Casey, then CEO of Tronox, observed that Tronox is "managing [its] production so that inventories get reduced to normal or below normal levels. And when that happens price will rise... From what we see with Chemours

and Huntsman and presumably the others as well, they're doing the same thing. We see them acting in the same way." (PX9005 at 010 (Tronox Q3 2015 Earnings Call)).

571. When asked in a 2016 earnings call about Tronox's production decisions, including capacity cuts at its Hamilton plant, Mr. Casey emphasized Tronox's focus on managing supply to support increasing prices, asserting that "a very disciplined approach to production, to managing supply relative to demand, is what has facilitated the recovery in our markets, and we intend to continue to be disciplined about that." (PX9003 at 010-11 (Tronox Q1 2016 Earnings Call)).

572. Tronox's internal correspondence confirms that **{** **}**. (PX1075 at 001 (Hinman/Casey email chain) (*in camera*); PX1074 at 001 (Casey/Turgeon email chain) (*in camera*); PX1231 at 014 (Tronox presentation) (*in camera*); PX1353 at 011 (Tronox presentation) (*in camera*)).

573. In 2012, John Romano wrote in an email to Tom Casey and Daniel Greenwell that **{** **} (**PX1015 at 001 (Romano email) (*in camera*)).

574. **{** **}** (PX1075 at 001 (Hinman/Casey email chain) (*in camera*)).

575. **{** [redacted] **}**, Mr. Turgeon, the head of Tronox's TiO2 business, wrote to then-CEO Mr. Casey that **{** [redacted] **}** (PX1074 at 001 (Casey/Turgeon email chain) (*in camera*)). Mr. Casey responded to this email, noting that **{** [redacted] **}** (PX1074 at 001 (Casey/Turgeon email chain) (*in camera*)).

576. In a 2016 draft presentation, **{** [redacted] **}** (PX1030 at 015 (Tronox presentation) (*in camera*)).

(b) Cristal's internal documents likewise demonstrate that the company recognizes that withholding chloride TiO2 output increases prices

577. In a 2006 strategy document, Cristal's predecessor company noted the importance of "Production match[ing] Sales (produce what we can sell at "market" price): Curtail production in a down market (don't use price to push volume)…Sacrifice share in a[n] up market." (PX2024 at 013 (Lyondell presentation)). The same presentation says that Cristal's predecessor company curtailed production in the third quarter of 2005 due to "market weakness." (PX2024 at 021 (Lyondell presentation)).

578. **{** [redacted]

[redacted]**}**

(PX6005 at 020 (Lyondell presentation) (*in camera*)).

579. In a 2009 market update document, Cristal noted that the TiO2 "industry continues to curtail" and indicates that those decisions have "long term implications." (PX2215 at 020 (Cristal Global Business Update)).

580. In 2011, Cristal executive Mark Stoll justified operating plants at reduced capacity stating that "this discipline of taking supply offline and allowing inventories to fall as demand improved lead to pricing discipline and pricing power over the following quarters." (PX2083 at 001 (Stoll/Najjar email chain)).

581. **{**[redacted]**}** (PX2000 at 007 (Cristal presentation) (*in camera*)).

582. A 2016 Cristal strategy presentation indicated that **{**[redacted]**}** (PX2116 at 005 (Cristal Presentation) (*in camera*)). That same document also noted that **{**[redacted]**}** (PX2116 at 005 (Cristal Presentation) (*in camera*)).

(c) Respondents' competitors also recognize that reducing chloride TiO2 output in North America can support higher prices

583. Kronos has observed that "structural improvements" in the TiO2 industry drove a $250 million increase in its earnings before interest, taxes, depreciation, and amortization (EBITDA) and that "baseline TiO2 capacity has been permanently reduced with limited near-term ability to increase capacity." (PX3011 at 015, 038 (Kronos presentation)).

584. Chemours likewise recognizes that reduced TiO2 output leads to higher pricing. Chemours possesses proprietary chloride titanium dioxide production technology that allows it to more easily "vary [its] production in line with customer demand." (PX9025 at 003 (Chemours presentation)). It has told investors that it will use this ability to operate "at lower levels of output when customer needs . . . warrant that we adjust our production." (PX9025 at 003 (Chemours May 2017 investor presentation transcript)). The company also acknowledges that "historically, pricing increases tied to high utilization." (PX9038 at 005 (May 2017 Chemours investor presentation)).

585. Consistent with that recognition, in connection with adding a new line at its Altamira facility in Mexico, Chemours announced it would "dial back production at our other sites to offset the new Altamira volumes until our customer demand warrants additional production." (PX9055 at 004 (Chemours Q1 2016 Earnings Call)). Those reductions included permanently closing its Edge Moor plant in Delaware, and shutting down a production line at its New Johnsonville, TN, plant, removing {[redacted]} of capacity. (PX2055 at 024 (Cristal presentation) (*in camera*)). Tronox cheered these developments as "good news," with Tronox's then CEO Mr. Casey remarking, "[i]t's good [Chemours] can follow the leader!" (PX1130 at 003 (Romano/Bender e-mail chain); PX1325 at 001 (Casey email)).

iii. Respondents Have a History of Withholding Output to Support North American Chloride TiO2 Pricing

(a) Tronox has reduced North American chloride TiO2 output over the past decade in order to support North American TiO2 prices

586. Tronox has reduced its North American TiO2 output over the past decade to support TiO2 pricing through both plant closures and throttled output. (*See* CCFF ¶¶ 587-612, below).

(1) Tronox has closed TiO2 production facilities to support TiO2 prices

587. Tronox's previous acquisition of North American TiO2 plants resulted in reduced TiO2 output in North America. (PX5000 at 081 (¶ 185) (Hill Initial Report) (*in camera*)); PX9070 at 001 (PR Newswire article); PX9078 at 001 (PR Newswire article); PX9069 at 001 (ICIS article)).

588. In 2000, Tronox's predecessor, Kerr-McGee, purchased Kemira's TiO2 operations in Savannah, GA, which consisted of a sulfate plant and a chloride plant. At the time of the acquisition, Kerr-McGee stated that the plants were part of its long-term strategy to grow the business. (PX9070 at 001 (PR Newswire article)).

589. At the time of the acquisition, Kerr-McGee claimed that because of its familiarity with the technology used at the acquired plants, it was better positioned to update them and make them more profitable than other potential buyers. (PX9078 at 001 (PR Newswire article)).

590. Despite those promises, Kerr-McGee closed the sulfate plant in 2004, citing a lack of demand for sulfate TiO2 in North America as a reason for the closure. (PX9069 at 001 (ICIS article)). Then, in 2009, Tronox closed the chloride TiO2 facility in Savannah, Georgia, **{** [redacted] **}** (PX1486 at 004 (Tronox presentation) (*in camera*); Romano, Tr. 2164–2165 (*in camera*)).

591. **{** [redacted] **}** (PX1299 at 001 (Engle email) (*in camera*)).

592. **{** [redacted] **}** (PX3000 at 003 (Venator 2017 Private-side Supplement) (*in camera*)). **{** [redacted] **}** (Romano, Tr. 2167 (*in camera*)).

593. **{** [redacted] **}** (PX1075 at 001 (Hinman/Casey email chain) (*in camera*)).

594. Fixed costs are not a deterrent to reducing output. As Tronox's then-CFO, Dan Greenwell, put it in 2012, "So that's [operating at 80 percent capacity utilization] not an uncomfortable position for us. Obviously we would like to be operating in the high 90s but we have reconfigured some of our activities and think we can do it profitably without a lot of fixed costs overhang associated with it." (PX9033 at 012 (Tronox Q2 2012 Earnings Call)).

(2) Tronox reduced its North American TiO2 output in 2012 in order to support North American chloride TiO2 prices

595. Tronox lowered its North American chloride output **{** **}**. (PX5002 at 006 (Figure 1) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*)).

596. Tronox's August 2012 Board Update shows that **{** **}**. A slide titled **{** **}** (PX1109 at 011 (Tronox presentation) (*in camera*)).

597. The August 2012 Board Update further described **{** **}**. (PX1109 at 021 (Tronox presentation) (*in camera*)). As part of these efforts, **{** **}**. (PX1109 at 021 (Tronox presentation) (*in camera*)). **{** **}**. (PX1109 at 025 (Tronox presentation) (*in camera*); PX1352 at 033 (Tronox presentation) (*in camera*)).

598. {[redacted]} (Romano, Tr. 2165-66 (*in camera*)). {[redacted]} (Romano, Tr. 2173-74 (*in camera*)). {[redacted]} (PX1025 at 002 (Santos email to Casey) (*in camera*)).

599. {[redacted]} (Romano, Tr. 2171-73 (*in camera*)). {[redacted]} (Romano, Tr. 2172-73 (*in camera*)). {[redacted]} (Romano, Tr. 2176 (*in camera*)).

600. {[redacted]} (PX5002 at 006 (¶9) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*)). In fact, {[redacted]}. (PX5002 at 006 (¶9) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*)).

(3) Tronox reduced its North American TiO2 output again in 2013 in order to support North American chloride TiO2 prices

601. Tronox reduced its North American chloride TiO2 output {[redacted]}. (PX5002 at 006 (Figure 1) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*)).

602. {[redacted]} (PX1349 at 009, 028 (Tronox presentation) (*in camera*)). {[redacted]} (PX1349 at 009 (Tronox presentation) (*in camera*)). Nevertheless, {[redacted]} (PX1349 at 008 (Tronox presentation) (*in camera*)).

603. {[redacted]} (PX1399 at 002 (Tronox investor presentation) (*in camera*)). {[redacted]} (PX1399 at 002 (Tronox investor presentation) (*in camera*)).

604. {[redacted]} during this period. (PX5002 at 006 (¶9)

(Hill Rebuttal Report) (*in camera*)). In fact, Tronox's average variable margin during that period, [redacted] its average variable margin during high-utilization times. Tronox's inventory was also [redacted] during this period than its average inventory when capacity utilization was [redacted] (PX5002 at 006 (¶9) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*)).

(4) Tronox reduced its North American chloride TiO2 output in 2015 in order to support North American chloride TiO2 prices

605. Tronox reduced its North American chloride output **{** [redacted] **}**. (PX5002 at 006 (Figure 1) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*); PX0003 at 012-17 (Tronox Second Request Narrative Response to Specification4(d)) (*in camera*)).

606. In a 2015 earnings call, Tronox's then CEO Mr. Casey explained, "It is our view that an upward move in pigment selling prices will be predicated on a reduction of supply in the pigment market relative to demand, and/or an upward move in feedstock selling prices and we expect to see both." (PX9007 at 005 (Tronox Q1 2015 Earnings Call)).

607. Following that call, Tronox idled [redacted] its Hamilton chloride TiO2 plant. (Romano, Tr. 2165 (*in camera*); PX0003 at 015 (Tronox Second Request Narrative Response to Specification 4(d)) (*in camera*)). Both **{** [redacted] **}** (PX7001 (Romano, IHT at 167) (*in camera*); PX7026 (Duvekot, Dep. at 148-49) (*in camera*)).

608. **{** [redacted]

[redacted]**}** (PX7007 (Van Niekerk, Dep. at 064) (*in camera*); *see also* PX7024 (Harper, Dep. at 42) (*in camera*); PX9003 at 011 (Tronox Q1 2016 Earnings Call)). **{**[redacted]**}** (Romano, Tr. 2165 (*in camera*)). While these curtailments caused Tronox to absorb about $30 million in fixed costs, the company found the benefits from doing so to outweigh the costs. (PX9003 at 011 (Tronox Q1 2016 Earnings Call)).

609. Mr. Romano of Tronox testified that **{**[redacted]**}** (PX7001 (Romano, IHT at 167) (*in camera*)).

610. In another 2015 earnings call, Tronox's then CEO, Tom Casey stated "And then the question is when will [the prices] turn. We're addressing that by managing our production, so that inventories get reduced to normal or below normal levels; and when that happens, prices will rise. We--from what we see with Chemours and Huntsman and presumably the others as well, they're doing the same thing. We see them acting in the same way." (PX9005 at 010 (Tronox Q3 2015 Earnings Call)).

611. **{**[redacted]**}** (PX1435 at 001 (Duvekot/Bianchi email chain) (*in camera*)). **{**[redacted]**}** (Duvekot, Tr. 1333-1335) (*in camera*)). Mr. Duvekot further explained that **{**[redacted]

[redacted]**}** (PX1435 at 001 (Duvekot/Bianchi email chain) (*in camera*)). Mr. Duvekot further stated that **{**[redacted]**}** (PX1435 at 001 (Duvekot/Bianchi email chain) (*in camera*)).

612. After conducting an economic analysis using Tronox's internal data, Dr. Hill also confirmed that **{**[redacted]**}**. (PX5002 at 006 (¶9 & Fig. 1) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*)).

(b) Tronox remains committed to adjusting output to support North American chloride TiO2 prices

613. Tronox remains committed to adjusting its output in order to support chloride TiO2 pricing in North America. (*See* CCFF ¶¶ 614-16, below). **{**[redacted]**}** (PX1074 at 001 (Casey/Turgeon email chain) (*in camera*)).

614. Tronox continues to abide by that strategy, even today in times of high demand, by adjusting output to support higher prices in North America. (PX9003 at 010 (Tronox Earnings Call Q1 2016); PX1333 at 010 (Tronox presentation) (*in camera*)). For example, a 2017 Tronox strategic document explained that **{** **}** (PX1333 at 010 (Tronox presentation) (*in camera*)). Matching supply to demand requires changing output with an aim toward maintaining more favorable pricing. (PX9005 at 010 (Tronox Q3 2015 Earnings Call)).

615. Similarly, despite strong North American demand (*see* CCFF ¶¶ 611, 614, above), **{** **}** (RX0510 at 0001 (Mei email) (*in camera*)). As Ms. Mei of Tronox told senior executives, **{** **}** (RX0510 at 0001 (Mei email) (*in camera*)).

616. Tronox has also indicated that the acquisition of Cristal will not change the company's strategy of limiting output to support pricing. (*See* CCFF ¶¶ 617-18, below). For example, in an earnings call in February 2017, Mr. Casey publically assured investors that Tronox would "still balance our supply with demand" after the acquisition. (PX9000 at 012 (Tronox Q4 2016 Earnings Call)).

617. During the February 2017 earnings call, Mr. Casey elaborated that "[Tronox] ha[s] tried to be economically rational over these last several years. If there was surplus supply in

the market, we slowed down our production, and we did that with respect to pigment. We also did it with respect to mineral sands. … [O]ver the last couple of years [] we shut down about 75,000 tons of pigment production when we felt that all we were doing was adding supply to inventory levels. And we shut down two of our four slag furnaces." (PX9000 at 012 (Tronox Q4 2016 Earnings Call)).

618. An internal Tronox document, **{** [redacted] **}**. (PX1233 at 016 (April 2017 Strategic Feedstock Planning document) (*in camera*)). Specifically, **{** [redacted] **}**. (PX1233 at 016 (April 2017 Strategic Feedstock Planning document) (*in camera*)).

(c) Cristal has also withheld chloride TiO2 output in North America to support chloride TiO2 pricing

619. Like Tronox, Cristal has, at various times, closed plants and managed supply to support chloride TiO2 prices in North America. (PX0002 at 021 (Cristal Second Request Response) (*in camera*); PX2083 at 001 (Stoll/Najjar email chain); PX2022 at 005-06 (Cristal presentation); PX2116 at 005, 010 (Cristal presentation) (*in camera*)).

620. **{** [redacted] **}** (PX0002 at 021 (Cristal Second Request Response) (*in camera*)). **{** [redacted] **}** (PX0002 at 015 (Cristal Second Request Response) (*in camera*)).

621. Respondents credited both those reductions with leading to large price increases over the next several years. (PX2083 at 001 (Stoll/Najjar email chain) ("the pricing momentum began when significant major capacity was taken off line in 2008 and 2009 during the financial crisis."); PX1109 at 011 (Tronox presentation) (*in camera*) ({ }}).

622. Cristal considered reopening Hawkins Point when prices rose dramatically in 2011 and 2012 but ultimately chose not to do so because, as Mark Stoll, then Cristal's commercial vice president, explained in a presentation, reopening the plant "should be assumed to have a reverse material impact on the pricing power we have achieved as of late." Mr. Stoll went on to comment that "the only certain factor is that the markets will remain tighter with greater pricing power the longer we leave [Hawkins Point] down and further capacity recovery will only act to stabilize upward pricing dynamics." (PX2022 at 006 (Cristal presentation)).

623. In addition to the plant closures, { } (PX5002 at 008 (Figs. 2-3) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*); PX0002 at 010-35, 105 (Cristal Second Request Response to Specifications 4(d) and 26) (*in camera*)).

624. This strategic approach of reducing TiO2 output to support pricing was consistent with Mr. Stoll's warning that "the ***'Evil Sin'*** would be to attempt to lower prices to take market share as markets weaken. ***We Must Hold Price!***" (PX2242 at 017 (Cristal presentation) (emphasis in original)).

625. According to Dr. Hill's economic analysis of Cristal's plant-level production data, Cristal's capacity utilization at its Ashtabula I plant was **{** [redacted] **}**. (PX5002 at 008 (Figure 2) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*)). Conducting a similar analysis using the same data, Dr. Hill showed that Cristal's capacity utilization at its Ashtabula II plant was **{** [redacted] **}**. (PX5002 at 008 (Figure 3) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*)).

626. Dr. Hill conducted an economic analysis using plant-level data, and found that **{** [redacted] **}** (PX5002 at 008 (Figs. 2-3) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*) PX0002 at 010-35; 105 (Cristal Second Request Response to Specifications 4(d) and 26) (*in camera*)). Also, Dr. Hill found that during all but two of those time period, **{** [redacted] **}** (PX5002 at 008 (Figs. 2-3) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*); PX0002 at 010-35; 105 (Cristal Second Request Response to Specifications 4(d) and 26) (*in camera*)).

627. In 2016, a Cristal executive observed that **{** [redacted] **}** (PX2112 at 002 (Snider email)

(*in camera*)). Those efforts included Cristal {[redacted]}. (PX0002 at 015 (Cristal Second Request Response to Specification 4(d)) (*in camera*)).

628. In 2016, Cristal observed that {[redacted]} (PX2116 at 005, 010 (Cristal presentation) (*in camera*)).

629. Cristal acknowledges that {[redacted]} (PX0002 at 014-020 (Cristal Second Request Response) (*in camera*)).

630. These various output reductions provide the basis for the concerns expressed by many market participants that the merger of Tronox and Cristal will lead to output suppression (*See* CCFF ¶¶ 713-20, 725-26, below). Both competitors and customers have recognized that the merged firm would have an even greater incentive to decrease output after the merger. (*See* CCFF ¶¶ 721-24, below).

(d) A recent real world example shows the impact an output reduction can have on TiO2 pricing

631. {[redacted]}

[redacted] (Hill, Tr. 1820-22 (*in camera*)).

632. In January 2017, Venator's TiO2 plant in Pori, Finland caught fire, forcing the closure of the plant. (PX3009 at 033 (Venator lender presentation) (*in camera*); PX7015 (Maiter, Dep. at 115-16, 139, 164) (*in camera*); PX7025 (Malichky, Dep. at 261) (*in camera*)). The plant has a nameplate capacity of about [redacted] metric tons of TiO2 annually. (PX3009 at 033 (Venator lender presentation) (*in camera*)). The plant is not projected to return to full capacity until [redacted] at the earliest. (PX3009 at 033 (Venator lender presentation) (*in camera*)).

633. Dr. Hill analyzed TiO2 producer invoice data and found that following the fire and loss of Pori's output, [redacted] (Hill, Tr. 1821-22 (*in camera*); PX5004 at 039 (¶¶ 89-90 & Fig. 17) (Hill Rebuttal Report to Shehadeh) (*in camera*)). While Tronox and Cristal's average North American price [redacted], respectively, their average prices in Europe [redacted] from January 2017 to December 2017. (PX5004 at 039 (¶ 90 & Fig. 17) (Hill Rebuttal Report to Shehadeh) (*in camera*); Hill, Tr. 1822 (*in camera*)). Prior to the fire at Venator's Pori, Finland plant, average European prices were [redacted] (PX5002 at 021 (¶ 44) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*)).

634. To the extent that alternative sources of supply, if any, replaced the Pori plant's lost output (presumably either imports or through arbitrage), it did so [redacted] and caused prices in Europe [redacted]

[redacted] (PX5002 at 021 (¶ 45) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*); Hill, Tr. 2036-37 ([redacted]) (*in camera*)).

635. The results of this natural experiment confirm Dr. Hill's conclusion that [redacted] (Hill, Tr. 1822 (*in camera*); PX5002 at 021 (¶ 45) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*)).

iv. North American Chloride TiO2 Producers Are Unlikely to Increase Output in North America Sufficiently to Offset a Price Increase Resulting from the Merged Firm's Unilateral Output Reduction

636. North American chloride TiO2 producers are unlikely to increase their output if prices were to rise in response to the merged firm's output reduction. Even in the current market without the proposed merger, the North American TiO2 producers recognize their mutual interdependence and avoid competing aggressively to maintain higher pricing. (*See* CCFF ¶¶ 427-59, above). Consistent with this, other North American chloride TiO2 producers believe that this merger is likely to lead to "continued capacity constraints" (Christian, Tr. 772; PX3011 at 038 (Kronos presentation)) and [redacted] (PX3000 at 004 (Venator presentation) (*in camera*)).

637. Further, in addition to the lack of incentive for the merged firm's North American rivals to increase output, even if North American producers wanted to increase output in response to the merged firm's output reduction, [redacted] (*See* CCFF ¶¶ 638-39, below). Kronos's worldwide utilization was over [redacted] in the first

half of 2017, (PX7035 (Christian, Dep. at 75-76) (*in camera*)), and TZMI reported its estimate of the North American utilization rate was {[redacted]} in 2016. (PX1663 (2017 TZMI Pigment Producers Cost Study spreadsheet) (*in camera*)). Venator had {[redacted]} in North America in 2016. (PX1663 (2017 TZMI Pigment Producers Cost Study spreadsheet) (*in camera*)). Likewise, Chemours has told investors that "we are seeing strong demand globally and are utilizing all our TiO2 plants at their full capability." (PX9059 at 004 (Chemours Q1 2017 Earnings Call Transcript)). Given this high demand, Chemours expected that long lead times for chloride TiO2 would continue. (PX9059 at 004 (Chemours Q1 2017 Earnings Call Transcript)).

638. Reflecting the lack of available capacity in North America, {[redacted]}. (PX7025 (Malichky, Dep. at 170-72) (*in camera*)). As Mr. Malichky explained, {[redacted]} (PX7025 (Malichky, Dep. at 172) (*in camera*)).

639. {[redacted]}. (PX7033 (Post, Dep. at 191-92) (*in camera*) ({[redacted]}); PX7030 (Arrowood, Dep at 13) (*in camera*) ({[redacted]}); PX7040 (Santoro, Dep. at 126-28) (*in camera*) ({[redacted]})).

640. Moreover, after conducting a detailed econometric analysis of how North American TiO2 suppliers responded to past price increases in North America, Dr. Hill concluded that neither imports to North America nor repatriated exports (i.e., a North American producer redirecting planned chloride TiO2 exports back to North America) are likely to discipline a price increase in North America resulting from output suppression. (Hill, Tr. 1929-30, 1932-33; *see* CCFF ¶¶ 641-57, below).

641. Dr. Hill examined both imports and export repatriation empirically relying on prior industry responses to price changes to determine whether they might discipline a price increase resulting from the unilateral withdrawal of chloride titanium dioxide by the merged firm. (Hill, Tr. 1774-75).

642. Specifically, Dr. Hill estimated how responsive imports of chloride titanium dioxide are to changes in the price of chloride titanium dioxide in North America based on how imports have responded to changes in price in North America in the past. (Hill, Tr. 1774). This measure is known as the price elasticity of imports. (Hill, Tr. 1691-92). Dr. Hill's analysis shows that any increase in imports would be small and insufficient to offset higher prices resulting from the merger. (Hill, Tr. 1774-75; PX5000 at 11-12 (¶¶ 21) (Hill Initial Report) ("Imports of chloride titanium dioxide are unlikely to offset any price increase that results from the merger.") (*in camera*)).

643. Dr. Hill also examined whether North American chloride TiO2 producers would reduce their exporting behavior and instead sell some of that product in North America. (Hill, Tr. 1775). That analysis shows that North American chloride TiO2 producers have historically not changed their exporting behavior in response to North American prices. (Hill, Tr. 1775-76, 1929-30, 1932-33; PX5000 at 142-43 (¶¶ 319-20) (Hill Initial Report)

(*in camera*); PX5004 at 021 (¶ 42) (Hill Rebuttal Report) ({ [redacted] }) (*in camera*)).

644. Dr. Hill's empirical conclusions regarding the lack of a response to higher chloride TiO2 prices in North America in the form of either imports or repatriated exports are supported by the evidence that there are persistent price differences by region. (PX5000 at 060-063 (¶¶ 138-143) (Hill Initial Report) (*in camera*)). Specifically, Dr. Hill's analysis shows that chloride TiO2 prices were { [redacted] } than those in the rest of the world { [redacted] } (Hill, Tr. 1723 (*in camera*); PX5000 at 060-063 (¶¶ 138-43) (Hill Initial Report) (*in camera*); *see* CCFF ¶¶ 232-58, above).

645. Imports of chloride TiO2 into North America have been, and remain, limited, even when chloride TiO2 prices in North America were significantly higher than those in the rest of the world. (PX5000 at 063-64 (¶¶ 144) (Hill Initial Report) (*in camera*)). For example, { [redacted] }. (PX5000 at 032-33 (¶ 78 & Figure 12) (Hill Initial Report) (*in camera*)).

646. The high costs of importing TiO2 into North America, including shipping and duties, limit imports. (PX5000 at 064-065 (¶¶ 146) (Hill Initial Report) (*in camera*); *see* CCFF ¶¶ 789-93, below). Those costs can { [redacted]

[redacted]**}**. (PX8005 at 004 (¶ 20) (Maiter Decl.) (*in camera*)); PX0003 at 038 (Tronox Second Request Narrative Response to Specification 16) ({[redacted]**}**) (*in camera*)).

647. Because of those costs, **{**[redacted]**}**. (PX7035 (Christian, Dep. at 77-78) (*in camera*); PX8002 at 003 (¶ 14) (Christian Decl.) (*in camera*); PX8005 at 004 (¶ 19) (Maiter Decl.) (*in camera*)). Those specialty grades typically earn a high margin that partially offsets the costs associated with shipping the product as well as the import duties. (PX8005 at 004 (¶¶ 19, 22) (Maiter Decl.) (*in camera*)).

648. Kronos indicated that **{**[redacted]**}** (PX7035 (Christian, Dep. at 77-78) (*in camera*)). It cited **{**[redacted]**}**. (PX7035 (Christian, Dep. at 77-78) (*in camera*)).

649. Moreover, **{**[redacted]**}** (PX3037 at 005 ({[redacted]**}**) (*in camera*)).

650. As Venator further explained, **{**[redacted]**}**. (PX8005 at 004 (¶ 21) (Maiter Decl.) (*in camera*)). As a result, the company believes **{**[redacted]

[redacted]

[redacted]**}**. (PX8005 at 004 (¶ 21) (Maiter Decl.) (*in camera*)).

651. Chloride TiO2 imports from China are also unlikely to offset the price effects of a North American output reduction. (*See* CCFF ¶¶ 745-812, below). Chinese chloride TiO2 production remains limited and demand for TiO2 is booming in China and nearby parts of Asia, resulting in tight supply, high prices, and reduced availability of Chinese TiO2 for export to North America. (*See* CCFF ¶¶ 775-88, below).

652. In addition to the evidence suggesting that increased imports by North American suppliers would be unlikely to discipline a price increase in North America, there is no evidence that North American producers have responded to higher prices in North America by redirecting their exports back to North America or that they would likely do so in the future. (*See* CCFF ¶¶ 653-57, below). This qualitative evidence that export repatriation has not occurred in the past is consistent with Dr. Hill's quantitative analysis showing that North American producers have not repatriated exports in the past. (*See* CCFF ¶ 643, above).

653. Chemours, **{**[redacted]**}**. (PX5000 at 038-039 (¶ 85 & Figure 16) (Hill Initial Report) (*in camera*)). **{**[redacted]**}** (PX7052 (O'Sullivan, Dep. at 146-47) (*in camera*) ({[redacted]

[redacted]

[redacted]**}**)).

654. In explaining **{**[redacted]**}**, Chemours's Mr. O'Sullivan testified that **{**[redacted]**}** (PX7052 (O'Sullivan, Dep. at 70) (*in camera*). He explained that **{**[redacted]**}**. (PX7052 (O'Sullivan, Dep. at 70) (*in camera*) (**{**[redacted]**}**)).

655. **{**[redacted]**}** with the economic intuition underlying Section 6.3.3 of the Merger Guidelines and Dr. Hill's unilateral effects analysis. Chemours has a very high market share in North America and as a result, is very sensitive to North American chloride TiO2 prices. (Hill, Tr. 1936-37). As a result, Chemours would be reluctant to repatriate exports because it would drive down North American prices. (Hill, Tr. 1936-37).

656. Mr. O'Sullivan also explained that **{**[redacted]**}**. (PX7052 (O'Sullivan, Dep. at 147) (*in camera*)).

657. Dr. Hill analyzed export data from Kronos and Venator, the remaining North American chloride TiO2 producers (other than the merged firm and Chemours), and found that Kronos and Venator have **{**[redacted]**}**. (PX5000 at 038 (¶ 85) (Hill Initial Report) (*in camera*)). As

a result, even if Kronos or Venator were to repatriate their North American chloride TiO2 exports, it would have limited impact on North American prices.

v. Economic Modelling Shows that the Merged Firm Has an Even Greater Incentive to Withhold Output than the Stand-alone Firms

658. The qualitative evidence and data show that suppliers of chloride TiO2 in North America have found it profit-maximizing in the past to withhold output to support North American TiO2 prices. (PX5004 at 041 (¶ 94) (Hill Rebuttal to Shehadeh) (*in camera*); *see* CCFF ¶¶ 586-630, above). Economic intuition, incorporated into Merger Guidelines § 6.3, suggests that a larger firm will capture more of the benefit of withholding output (i.e., a price increase) than a smaller firm because it accounts for a larger proportion of the market and have an greater incentive to reduce output. (Hill, Tr. 1764-69; PX5000 at 011, 069-75 (¶¶ 17, 159-77) (Hill Initial Report) (*in camera*)).

659. Dr. Hill conducted an independent empirical analysis to test whether this intuition would hold true here (i.e., whether the Tronox/Cristal merger would increase the incentives of the merged firm to withhold output relative to those of the stand-alone firms). He used two standard economic models commonly applied to oligopoly commodity markets—the capacity closure model and the Cournot model to estimate the merger's impact on unilateral incentives. (Hill, Tr. 1759-60; PX5000 at 011 (¶ 18) (Hill Initial Report) (*in camera*)). Both models showed that the merged firm has a significantly increased incentive to reduce output relative to the stand-alone firms today, meaning that the merger is likely to lead to higher North American chloride TiO2 prices and customer harm. (Hill, Tr. 1764-1769; PX5000 at 011, 069-75 (¶¶ 17-18, 159-77) (Hill Initial Report) (*in camera*)).

(a) The capacity closure model predicts that the merged firm has a stronger incentive to reduce output than the stand-alone firms

660. The capacity closure model predicts that the transaction is likely to have an anticompetitive effect in the North American chloride TiO2 market by increasing the incentives of the merged firm relative to each of the stand-alone firms to reduce output today. (Hill, Tr. 1858).

661. Dr. Hill developed the capacity closure model to assess a merger's impact on incentives to withhold output in markets involving relatively homogenous products and high fixed costs. (Hill, Tr. 1771). Those conditions are met by the chloride TiO2 industry. (Hill, Tr. 1771).

662. The capacity closure model has been employed by the Department of Justice's Antitrust Division in a number of merger matters, has been accepted by at least one federal court in *Unites States v. Abitibi Consol., Inc.*, 584 F. Supp. 2d 162 (D.D.C. 2008), and has been the subject of published articles. (Hill, Tr. 1770-71).

663. The capacity closure model focuses on whether a merger changes the merged firm's incentives to reduce output relative to the stand-alone firms. (Hill, Tr. 1772; PX5002 at 011 (¶16) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*)).

664. The capacity closure model computes the benefits and costs to a firm of withholding output. (PX5000 at 085-086 (¶ 190) (Hill Initial Report) (*in camera*)). If the benefits are greater than the costs, the merged firm is likely to have an incentive to reduce output. (PX5000 at 085-086 (¶ 190) (Hill Initial Report) (*in camera*)). To do that, the model assesses both the firm's costs of closing capacity and whether the potential price increase

would be defeated by customers turning to other products or sources of supply. (PX5000 at 086 (¶¶ 191-94) (Hill Initial Report) (*in camera*)).

665. In running the capacity closure model, Dr. Hill relied on the Respondents' own documents and data, including various internal assessments of the likely costs of idling production lines or closing plants, to assess the costs of actually doing so. (PX5000 at 086, 147-50 (¶¶ 191, 331-49) (Hill Initial Report) (*in camera*)). Those costs include manufacturing and variable costs for an idling scenario and both actual variable and fixed costs for a closure scenario. (PX5000 at 149 (¶¶ 344-46) (Hill Initial Report) (*in camera*)).

666. The capacity closure model also considers whether customers would switch to a different product altogether or if a response from rivals (i.e., increased output, imports, or export repatriation) would render the merged firm's output reduction unprofitable. (Hill, Tr. 1772; PX5000 at 086 (¶¶ 193-94) (Hill Initial Report) (*in camera*)).

667. In specifying the extent to which the model allowed both customers to switch products and rivals to respond, Dr. Hill relied on real-world, historical data to calculate various elasticities of demand (i.e., whether customers would switch to another product if TiO2 prices rose) and supply (i.e., responsiveness of imports, export repatriation, and increases in North American output) to determine whether the output reduction would be profitable. (PX5000 at 086, 148, 150 (¶¶ 193-94, 338-40, 348-49) (Hill Initial Report) (*in camera*); PX5004 at 041-044 (¶¶ 97-104) (Hill Rebuttal to Shehadeh) (*in camera*)). As Dr. Hill testified, Dr. Hill's capacity closure model incorporates demand growth and contemplates the one-year response period. (Hill, Tr. 1983). Dr. Hill incorporated those elasticities, which showed that in response to a North American price increase, imports

do not significantly increase and domestic producers do not reduce exports, into the capacity closure model. (Hill, Tr. 1772, 1774-75; PX5000 at 086, 148-50 (¶¶ 193-94, 338-40, 348-49) (Hill Initial Report) (*in camera*); (PX5004 at 042 (¶¶ 98-99) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

668. The capacity closure model predicts that, under current market conditions, the merged firm would have **{** **}** (Hill, Tr. 1776, 1826-27 (*in camera*)). It shows that **{** **}** (Hill, Tr. 1826-27 (*in camera*); PX5000 at 087 (¶199) (Hill Initial Report) (*in camera*)).

669. The scale of the output reduction scenarios predicted by the capacity closure model, including the most profitable scenario, is similar to those taken by the Respondents combined during prior periods of output reduction. The capacity closure model predicts that the most profitable outcome for the merged firm would be **{** **}** (PX5000 at 088 (¶¶ 199-200 & Fig. 33) (Hill Initial Report) (*in camera*)). In 2015, for example, Tronox idled **{** **}** (Romano, Tr. 2165 (*in camera*); PX0003 at 015 (Tronox Second Request Narrative Response to Specification 4(d)) (*in camera*); PX5002 at 008 (Fig. 2) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*)).

670. To confirm that the merger increases the incentives to withhold output, Dr. Hill checked whether the model predicts that the stand-alone firms have an incentive to withhold output today. (Hill, Tr. 1777; PX5000 at 088 (¶201) (Hill Initial Report) (*in camera*)). The capacity closure model shows that absent the merger, neither stand-alone Tronox nor

stand-alone Cristal have an incentive to reduce output, demonstrating that the merger creates an incentive to reduce output. (Hill, Tr. 1777; PX5000 at 088-89 (¶ 202-04) (Hill Initial Report) (*in camera*)). This model's "change in incentives compared to those of the stand-alone firms is the model's key conclusion, rather than a specific prediction" of harm. (PX5002 at 011 (¶16) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*)).

(b) Dr. Shehadeh's attack on the capacity closure model is unavailing

671. Dr. Shehadeh argues that Dr. Hill's capacity closure model underestimates rivals' responses to the merged firm's output reduction. (Hill, Tr. 1787). Not only is this argument belied by the qualitative evidence and data in this case, *see* CCFF ¶¶ 636-57, above, but it also relies on flawed econometrics and misrepresented measures of likely responses. (*See* CCFF ¶¶ 672-79, below). Finally, as Dr. Hill testified, {[redacted]} (Hill, Tr. 1829 (*in camera*)).

672. First, Dr. Shehadeh contends that Dr. Hill's initial capacity closure model overly restricts the responses of imports. (Hill, Tr. 1787). Dr. Shehadeh calculated his own import elasticity, but his analysis is flawed for multiple reasons. First, it suffers from a multicollinearity problem. Multicollinearity makes it hard to accurately estimate the causal effects of the different variables. Dr. Hill shows that Dr. Shehadeh's regression models exhibit the signs of multicollinearity. (Hill, Tr. 1787-89; PX5004 at 015-16 (¶¶ 27-34) (Hill Rebuttal Report to Shehadeh) (*in camera*)). In addition, Dr. Shehadeh also limits the time period he considers, excluding both older and more recent data. (Hill, Tr. 1787-89; PX5004 at 017 ((¶¶ 35-39) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

Both flaws result in a significant overestimate of the responsiveness of imports if TiO2 prices rose in North America. When the issues are addressed, Dr. Shehadeh's approach yields results similar to Dr. Hill's. (Hill, Tr. 1788-89; PX5004 at 016, 019 (¶¶ 34, 39) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

673. Dr. Shehadeh also relies on an estimate from a 2006 academic paper by Broda and Weinstein (RX1069) that he claims is an import elasticity to support his claim that imports are highly responsive to price changes in North America. (Hill, Tr. 1789-93). However, Dr. Shehadeh misrepresents the nature of that estimate. (Hill, Tr. 1790-93). As the paper makes clear, though, it is actually focused on whether U.S. consumers would substitute between TiO2 imports from different countries when the prices of those imports varies, not whether they would switch to imports over domestic TiO2. (Hill, Tr. 1790-92; RX1069 at 001-002 (showing that "the unmeasured growth in product variety from U.S. imports has been an important source of gains from trade" and finding "that consumers have low elasticities of substitution across similar goods produced in different countries"). As such, the elasticity that Dr. Shehadeh cites greatly overstates the likely responsiveness of imports if TiO2 prices rose in North America. (Hill, Tr. 1793).

674. To be conservative, Dr. Hill reran his capacity closure model in his rebuttal report to account for various import elasticities, including an estimate using Dr. Shehadeh's methodology and one derived from an economic paper cited by Dr. Shehadeh, and applied it to both all imports and adjustable imports. (PX5004 at 042 (¶¶ 98-99) (Hill Rebuttal to Shehadeh) (*in camera*)). Even with these adjustments, the model's predictions that the merged firm has an increased incentive to reduce output remained unchanged,

affirming the robustness of the model's results. (Hill, Tr. 1797; PX5004 at 042 (¶ 99 and Figure 19) (Hill Rebuttal to Shehadeh) (*in camera*)).

675. Dr. Shehadeh also claims that Dr. Hill's export repatriation elasticity is too low. (Hill, Tr. 1787). Dr. Shehadeh never calculates his own export repatriation elasticity, and instead relies on an estimate from a 2008 academic paper from Broda et al. (RX1068) that he claims is an export repatriation elasticity to support that claim. (Hill, Tr. 1793-96; PX5004 at 021, 042 (¶¶ 43, 100) (Hill Rebuttal to Shehadeh) (*in camera*)). However, as with the 2006 Broda paper, Dr. Shehadeh also misrepresents the nature of that estimate. (Hill, Tr. 1793-96). Not only is it an estimate for anatase rather than rutile TiO2, but it is also not, in fact, an export demand elasticity at all, but more akin to an import supply elasticity. (Hill, Tr. 1793-96; PX5004 at 022, 042 (¶¶ 45, 100) (Hill Rebuttal to Shehadeh) (*in camera*)). Not surprisingly, then, this estimate is very close to Dr. Hill's own estimate of import supply elasticity. (PX5004 at 022 (¶ 45) (Hill Rebuttal to Shehadeh) (*in camera*)). Accordingly, Dr. Hill's export repatriation elasticity is unrebutted. (PX5004 at 042 (¶ 100) (Hill Rebuttal to Shehadeh) (*in camera*)).

676. Dr. Shehadeh further states that Dr. Hill only allows a fraction of imports to respond to changes in price, causing it to over-predict harm. (Shehadeh, Tr. 3364). Dr. Shehadeh's claim is erroneous as Dr. Hill's rebuttal report contains analyses allowing all imports to respond to changes in price, and the results continue to predict that the merged firm would have an incentive to withhold output. (PX5004 at 042 (¶ 99) (Rebuttal Expert Report to Dr. Shehadeh) (*in camera*))

677. Finally, contrary to Dr. Shehadeh's claims, there is also no evidence that North American rivals could or would expand North American production beyond the growth in demand to offset a price increase in North America. (*See* CCFF ¶¶ 678-79, below).

678. Dr. Shehadeh argues that Dr. Hill's capacity closure model fails to predict Chemours's behavior, but he overlooks that Chemours has recently taken steps to limit its potential output by shuttering its Edge Moor plant and a line at New Johnsonville in 2015. (PX2055 at 024 (Cristal presentation) (*in camera*)). Dr. Shehadeh also ignores data, which suggests that **{** [redacted] **}** (PX5004 at 044 (¶ 104) (Hill Rebuttal Report to Shehadeh) (*in camera*)). Additionally, Dr. Hill did not have the detailed internal cost data from Chemours that he had from Tronox or Cristal. (PX7056 (Hill, Dep. at 122-24) (*in camera*)).

679. Dr. Shehadeh also argues that a price increase resulting from the merger would prompt chloride TiO2 suppliers to increase their supply of chloride TiO2 to the North American market and render the output reduction predicted by the capacity closure model unprofitable. (Shehadeh, Tr. 3373-74; Hill, Tr. 1985). Both historical experience in the North American TiO2 industry and Dr. Hill's empirical work, including the elasticities of supply which reflect that reality and are specifically incorporated into the capacity closure model, show that such a response in the form of increased North American production, imports, or repatriated exports is unlikely to occur. (*See* CCFF ¶¶ 667, 674-75, above). Indeed, **{** [redacted] **}** (PX5000 at 033 (¶ 78 & Fig. 12) (Hill Initial Report) (*in camera*)). It would also require that **{** [redacted]

[redacted] **}** (PX5000 at 032 (¶ 78 & n.132) (Hill Initial Report) (noting that **{** [redacted] **}**) (*in camera*)).

(c) The Cournot model also predicts that the merged firm has a stronger incentive to reduce output relative to the stand-alone firms

680. In addition to the capacity closure model, Dr. Hill also tested the impact of the merger using a Cournot model. (Hill, Tr. 1778, 1859). Like the capacity closure model, the Cournot model also examines whether the merger changes the incentives for the merged firm relative to the stand-alone firms to withhold output from the market. (Hill, Tr. 1778).

681. The Cournot model is "widely used by economists who are analyzing concentrated commodity markets. This makes it a natural choice for analyzing the chloride TiO2 market." (PX5000 at 090 (¶ 205) (Hill Initial Report) (*in camera*)); Hill, Tr. 1779; RX1072 at 0003 (Greenfield et al. paper) ("The Cournot model is a standard framework for analyzing issues of market power in homogenous goods industries"); RX1072 at 0003, n.4 (Greenfield et al. paper) ("Surveys on economic theories relevant to antitrust emphasize the importance of Cournot models for homogenous good industries.")).

682. The Cournot model has a few differences from the capacity closure model. (PX5000 at 090 (¶ 207) (Hill Initial Report) (*in camera*)). While Dr. Hill accounted for rivals' responses in his capacity closure model using data reflecting historical responses, Cournot allows rivals to readily adjust their output in response to the actions of the merged firm. (Hill, Tr. 1778-79 ("in the Cournot model, rivals can have an unbridled

response. They can bring to bear any amount of capacity they find profitable."); PX5000 at 090 (¶ 207) (Hill Initial Report) (*in camera*)). It also assumes that all firms behave strategically, accounting for the understanding among competitors that output decisions play an important role in chloride TiO2 pricing. (PX5000 at 090 (¶ 207) (Hill Initial Report)(*in camera*)).

683. Dr. Hill employed two models here because there are benefits to analyzing the effect of the merger using these different models. (Hill, Tr. 1778; PX5000 at 090 (¶ 206) (Hill Initial Report) (*in camera*)). It tests the accuracy of the prediction made by each individual model. (PX5000 at 090 (¶ 206) (Hill Initial Report) (*in camera*)). If both models, despite their differences, predict similar effects, "it shows that the prediction of an anticompetitive effect is robust and not unduly reliant on specific modeling assumptions." (PX5000 at 090 (¶ 206) (Hill Initial Report) (*in camera*); Hill, Tr. 1778 ("To check how robust my findings were…")).

684. Dr. Hill's Cournot model predicts that the merger would lead to higher chloride TiO2 pricing in North America relative to the but-for world absent the merger unless the merger were to generate a more than 70 percent reduction in the merged firm's marginal cost as compared to those of the stand-alone firms. (Hill, Tr. 1781; PX5000 at 090-091 (¶209) (Hill Initial Report) (*in camera*). Such a dramatic reduction in the firm's marginal cost far exceeds any measure of the efficiencies even claimed by the merging parties let alone what analysis suggests is likely. (Hill, Tr. 1781; PX5000 at 090-091 (¶209) (Hill Initial Report) (*in camera*)). Consequently, the Cournot model, like the capacity closure model, predicts that the merger increases incentives to withhold output and will result in

higher prices for chloride TiO2 in North America. (Hill, Tr. 1781; PX5000 at 090-091 (¶209) (Hill Initial Report) (*in camera*)).

(d) Dr. Shehadeh's criticism of Dr. Hill's Cournot model is unavailing

685. Dr. Shehadeh's criticisms of Dr. Hill's Cournot model are unavailing. (*See* CCFF ¶¶ 686-94, below).

686. First, Dr. Shehadeh describes the Cournot model as being biased towards concluding that mergers will be anticompetitive. (Shehadeh, Tr. 3390-91). Significantly, however, even the paper that Dr. Shehadeh affirmatively endorses for its approach actually endorses the usage of the Cournot model for understanding the competitive dynamics in commodity industries. Specifically, it states, "The Cournot model is a standard framework for analyzing issues of market power in homogenous goods industries." To substantiate this conclusion it includes the following footnote, "Surveys on economic theories relevant to antitrust emphasize the importance of Cournot models for homogenous good industries. See, for example, Werden and Froeb (2008) and Kaplow and Shapiro (2007)." (RX1072 at 0002 (Greenfield et al.)). Not only is Cournot a standard oligopoly model, but the relevant question is not the prediction of harm itself, but its magnitude. Here, Dr. Hill's Cournot model predicts a substantial price increase from the merger—over eight percent. (PX5004 at 047 (¶ 115) (Hill Rebuttal Report to Shehadeh)).

687. Second, Dr. Shehadeh's claim that Dr. Hill's Cournot model imposes limits on the abilities of rivals to respond is an erroneous depiction of how the Cournot framework functions. (Shehadeh, Tr. 3388). In a Cournot model, rivals can freely alter their production choices. The only constraint on their decision-making is that they seek to maximize their overall profits while also expecting all other firms in the marketplace to

be behaving similarly. Thus, any inhibitions on the magnitude of rivals' supply responses reflect their recognition of the oligopolistic nature of the market and the impact on price of additional supply. Dr. Hill explains these issues, citing to canonical textbooks on industrial organization, in his initial report. (PX5000 at 88-89 (¶¶ 205-09) (Hill Initial Report) (*in camera*)).

688. Furthermore, Dr. Hill shows that the qualitative record indicates that there are multiple factors suggesting that the Cournot model may actually be too conservative in how fluidly it allows rivals to respond. He notes that there is significant evidence suggesting that many of the merging parties' rivals in the North American market would struggle to increase their sales as predicted by the Cournot model. (PX5004 at 51-52 (¶¶ 131-33) (Rebuttal Expert Report to Shehadeh) (*in camera*)).

689. Dr. Shehadeh criticizes the marginal costs implied by Dr. Hill's Cournot model because he claims they are inconsistent with the marginal costs Dr. Hill used in the capacity closure model. (Shehadeh, Tr. 3401-02). However, Dr. Shehadeh's criticism fails because he conflates total costs with marginal costs. As Dr. Hill explained, the capacity closure model uses total costs in reaching its predictions, while the Cournot model focuses only on marginal costs. (PX5004 at 41 (¶ 112) (Hill Rebuttal Report to Shehadeh) (*in camera*)). Thus, the prediction performed by Dr. Shehadeh was comparing apples to oranges and was not probative of the Cournot model's validity. (PX5004 at 41 (¶ 112) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

690. Moreover, Dr. Hill presents a table comparing the variable costs implied by the Cournot model with those taken from accounting and third party data, and shows that they are

similar, affirming the accuracy of his model. (PX5004 at 46 (¶112 & Fig. 21) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

691. In another unavailing effort to undermine Dr. Hill's Cournot model, Dr. Shehadeh, without justification, applied an alternative modeling framework to Dr. Hill's Cournot model and claims that doing so reduces the predicted price increase from the merger. (Shehadeh, Tr. 3403-06). First, Dr. Shehadeh's reliance on the Greenfield et al. approach is unwarranted here. While Greenfield was attempting to address a quirk in the California refinery market where the standard Cournot model predicted marginal costs that were below the cost of one of the inputs to the finished product, an implausible result, no such issues arise here because the margins predicted by Cournot are similar to observed data, undermining the use of the Greenfield et al. approach. (PX5004 at 048 (¶¶ 117-19) (Hill Rebuttal Report to Shehadeh) (*in camera*)). Moreover, as Dr. Hill shows in his rebuttal report, altering the Cournot model so that it more closely resembles that used by Greenfield et al. has trivial impact on the predicted price increase, lowering it from 8.4% to 8%. (PX5004 at 047-51 (Section 5.B.2) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

692. Dr. Hill shows that allowing fringe firms to be more responsive—as done in the Greenfield et al. model—does not have a large impact on the predicted harm from the merger. (PX5004 at 047-51 (Section 5.B.2) (Hill Rebuttal Report to Shehadeh) (*in camera*)). Instead, the driving force behind Dr. Shehadeh's smaller predicted price increase is the margin earned on Tronox's final sale that he imposes, which ultimately determines what all market participants are earning on their own final sales. (PX5004 at 047-51 (Section 5.B.2) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

693. Dr. Shehadeh's imposition of a margin of 11% for Tronox's final sale is neither justified by the Greenfield et al. paper nor is it well-founded in the evidence assembled in the record. (*See* RX0170 at 186 (¶ 315) (Shehadeh Expert Report)). As Dr. Hill explains, the usage of the difference between the North American price and the world price is not consistent with reasonable econometric examinations of market participant behavior. Moreover, it is out of step with evidence that Dr. Shehadeh himself assembled on the variation in capacity utilization of different plants. (PX5004 at 44-45 (¶¶ 122-25) (Hill Rebuttal Report to Shehadeh) (*in camera*)).

694. Dr. Shehadeh also argues that the Cournot model is unreliable because it predicts that the merger would not be profitable. (Shehadeh, Tr. 3390, 3398-99). Dr. Shehadeh's conclusion is incorrect as Dr. Hill explains that firms value total profits, not just variable ones. (PX5004 at 052 (¶ 134) (Hill Rebuttal to Shehadeh)). Thus, even if a merger lowers variable profits in a market, it may be worth pursuing if it also lowers fixed costs or affects profits in some other market. Thus, Dr. Shehadeh's focus on the variable profitability of the transaction is misplaced. (PX5004 at 052 (¶ 134) (Hill Rebuttal to Shehadeh)). Dr. Hill also notes that the qualitative record suggests that there are multiple factors suggesting that the Cournot model may actually be too conservative in how fluidly it allows rivals to respond. He notes that there is significant evidence suggesting that many of the merging parties' rivals in the North American market would struggle to increase their sales as predicted by the Cournot model. (PX5004 at 051-52 (¶ 131-33) (Hill Rebuttal to Shehadeh)).

C. <u>The Merger Will Eliminate Beneficial Competition Between Tronox and Cristal</u>

695. In addition to the potential for unilateral output reduction, this merger will also eliminate beneficial head-to-head competition between the merging parties. (*See* CCFF ¶¶ 696-703, below). The Horizontal Merger Guidelines warn that mergers can harm a market when "a merger between two competing sellers prevents buyers from playing those sellers off against each other in negotiations. This alone can significantly enhance the ability and incentive of the merged entity to obtain a result more favorable to it, and less favorable to the buyer, than the merging firms would have offered separately absent the merger." (PX9085 at 025 (Horizontal Merger Guidelines, § 6.2).

696. Tronox and Cristal compete head-to head for many accounts, benefitting customers. For example, both Cristal and Tronox have competed to win volume at {[redacted]} (PX1017 at 001, 003 (Wilson email to Mouland (*in camera*)). {[redacted]} (Mouland, Tr. 1162 (*in camera*)).

697. Similarly, in an effort to obtain more favorable pricing from its current supplier, Tronox, Deceuninck North America, a plastics manufacturer, has reached out to Cristal as a potential source of supply that would compete with Tronox. (Arrowood, Tr. 1069-71).

698. PPG, a manufacturer of architectural and industrial coatings, currently purchases {[redacted]}. (Malichky, Tr. 293-94 (*in camera*); PX8000 at 002 (¶ 8) (Malichky Decl.) (*in camera*)). {[redacted]} (Malichky, Tr. 324-25; 609-10 (*in camera*)). Specifically, {[redacted]}

[redacted]

[redacted]**}**. (PX8000 at 002 (¶ 8) (Malichky Decl.) (*in camera*)).

699. Those benefits may be coming to an end if this merger is consummated. During PPG's recent negotiations with Tronox, John Romano, Tronox's Chief Commercial Officer, informed PPG that Tronox intends to raise PPG's price for chloride TiO2 if the merger is completed. (Malichky, Tr. 280-81; 561). Specifically, Mr. Romano told PPG that Tronox plans to raise the premerger price PPG receives from Cristal because Cristal lacks "market discipline" and "give[s] [TiO2] away" at prices that are too low. (Malichky, Tr. 280-81). Tronox told PPG that **{**[redacted]**}** (Malichky, Tr. 285-86 (*in camera*)). Tronox also told PPG that **{**[redacted]**}** (Malichky, Tr. 284-85 (*in camera*); Malichky, Tr. 563).

700. In the U.S. and Canada, **{**[redacted]**}** (Malichky, Tr. 286 (*in camera*)). **{**[redacted]**}** (Malichky, Tr. 289 (*in camera*)). **{**[redacted]**}** (Malichky, Tr. 289-91 (*in camera*)).

701. **{**[redacted]**}** (Malichky, Tr. 325 ({[redacted]

[redacted]

[redacted]**}**) (*in camera*)).

702. Masco, the manufacturer of Behr paint, **{**[redacted]

[redacted]

[redacted]

[redacted]**}**. (Pschaidt, Tr. 996-97 (*in camera*)).

703. In addition to price effects, Tronox's acquisition of Cristal could also harm customers in other ways. **{**[redacted]

[redacted]

[redacted]

[redacted]**}** (Malichky, Tr. 329-30 (*in camera*)).

D. Industry Participants Believe Consolidation Will Lead to Higher Chloride TiO2 Prices in North America

704. The evidence is clear that Tronox and Cristal, as well as customers and TiO2 competitors, projected that the Acquisition would result in reduced competition and higher prices. (*See* CCFF ¶¶ 705-24, below). This evidence supports the overall conclusion that the Acquisition would violate Section 7. (PX9085 at 007-09 (Horizontal Merger Guidelines, § 2.2); Hill, Tr. 1841-42; PX5000 at 106-08 (¶¶248-250) (Hill Initial Report) (*in camera*)).

705. Cristal and Tronox both recognize **{**[redacted]

[redacted]**}** For example, in a December 2015 Marketing and Sales presentation, Cristal stated that **{"**[redacted]

[redacted] **}** (PX2000 at 013 (Cristal presentation) (*in camera*)). In the same presentation, Cristal observed that {[redacted] **}** (PX2000 at 013 (Cristal presentation) (*in camera*)).

706. Tronox also believes that the acquisition will lead to higher pricing for chloride TiO2. In February 2017, in response to a congratulatory email from the Chairman of Huntsman, Tom Casey, CEO of Tronox responded that the acquisition would be good for the merged firm and its competitors as well: "Nevertheless, I am very happy that we were able to put it together since I think it will be very good for our shareholders - and if today's market reaction is an indication, for yours, and Chemours' and Kronos' too." (PX1045 at 001 (Casey email)).

707. Further, a few weeks after the acquisition, Tronox's Mr. Mouland emailed one of his sales team, Adrian Santos, stating that **{**[redacted] **}** (PX1038 at 001 (Mouland email) (*in camera*)).

708. A conversation between Tronox and PPG confirms that Tronox believes the acquisition will lead to higher chloride TiO2 pricing in North America. At trial, PPG's Mr. Malichky testified that Tronox's Mr. Romano and Mr. Mouland were explicit in telling PPG that Tronox intended to raise PPG's price after the acquisition: "Q: And what specifically did Mr. Romano tell you about what they were planning to do with price? A. They were

planning on raising the Cristal price at PPG. After the -- and let me -- after the transaction is complete, obviously, but after the transaction, they were going to raise the Cristal price." (Malichky, Tr. 280-81).

709. According to PPG's Mr. Malichky, Mr. Romano attributed Cristal's low pricing to a lack of "market discipline": "Q. And did Mr. Romano explain why? A. We had a long conversation about that that day, and we've had other conversations with him. And it relates to market discipline. Q. What do you mean by "market discipline"? A. Market discipline, as the way it was explained to me during that meeting and other meetings, is to be able to sell the product at a reasonable price and modulate production accordingly, and Cristal didn't have market discipline." (Malichky, Tr. 281).

710. Mr. Malichky's testimony is consistent with a contemporaneous email he sent to his supervisor in July 2017, describing "multiple conversations" with Tronox Senior Management, John Romano in particular. In these conversations, Mr. Romano stated that "Cristal's price is too low in the market," and that "Tronox would like to harmonize the price at customers (including PPG) and this could mean increasing the Cristal price up to the Tronox price at PPG." The email further states that "in USCA [the United States and Canada] the current price difference is **{** [redacted] **}** and this harmonization would cost PPG **{** [redacted] **}**. (PX4079 at 002 (Malichky email) (*in camera*)).

711. Mr. Malichky's testimony is also consistent with internal Tronox documents. For example, in an internal email, Tronox's Mr. Mouland stated that **{** [redacted] **}** (PX1038 at 001 (Mouland email) (*in camera*); PX1300 at 001 (Mouland email to

Newman) ({ [redacted] }) (*in camera*); PX1740 at 001 (Newman email) ({ [redacted] }) (*in camera*)).

712. Both Mr. Romano and Mr. Mouland testified at trial and had the opportunity to state under oath that Mr. Malichky's recollection was inaccurate. Mr. Romano did not even mention Mr. Malichky's testimony on the discussion between PPG and Tronox. (Romano, Tr. 2135-2292 (providing no testimony addressing Mr. Malichky's testimony) (partially *in camera*)). Mr. Mouland discussed the July 2017 meeting but did not dispute Mr. Malichky's claims that Tronox said it would increase prices. (Mouland, Tr. 1218-20, 1256-69 (partially *in camera*)).

713. [redacted] (*See* CCFF ¶¶ 714-20, below).

714. Mr. Vanderpool, Division Vice President for Paint for True Value, a cooperative of 4500 members that operate retail stores nationwide, [redacted]

[redacted] } (Vanderpool, Tr. 213-14 (*in camera*)). Mr. Vanderpool further testified that {[redacted]} (Vanderpool, Tr. 213-14 (*in camera*)).

715. Mr. Pschaidt, Vice-President of Procurement for Masco, which manufactures the Behr line of architectural coatings, [redacted] {[redacted]} (Pschaidt, Tr. 997 (*in camera*)).

716. As Mr. Santoro, the Vice-President of Global Procurement for Ampacet, a major producer of plastics masterbatch, wrote, {[redacted]} (PX4130 (Santoro email) (*in camera*)). In particular, Mr. Santoro testified that {[redacted]} (PX7040 (Santoro, Dep. at 122-23, 125-26) (*in camera*)).

717. Steve DeCastro, the Vice-President of Purchasing for RPM, a producer of the Rust-Oleum paints, testified that he had concerns about the merger because "when you have less producers, it's not good for buyers." (PX7016 (DeCastro, Dep. at 127)).

718. As Mr. Post of Akzo Nobel, a multi-national coatings manufacturer, testified at his deposition, there is a high risk that the merged firms closes a plant after the acquisition. (PX7033 (Post, Dep. at 127-28)). Mr. Post's concern is based on what happened in the TiO2 industry after a recent acquisition: "[W]hen [Venator] acquired Rockwood," it closed a plant and "it did have a material impact on the market." (PX7033 (Post, Dep. at 127-28)).

719. Even if the merged firm decided not to reduce output, Mr. Post still has concerns about the merger because North American chloride TiO2 "is a very consolidated market, probably the top 5% suppliers in the world sits on 60% of global capacities and therefore, you know, Tronox Cristal would have a stronger power position versus AkzoNobel." (PX7033 (Post, Dep. at 129)).

720. Curtis Zamec, the owner of Mississippi Polymers, testified to [redacted] {[redacted]} (PX7049 (Zamec, Dep. at 97-98)).

721. Further, Tronox's TiO2 competitors have made clear in public disclosures to their investors after the acquisition was announced that that increased TiO2 consolidation from the proposed acquisition would lead to a reduced level of competition and therefore increased pricing. (*See* CCFF ¶¶ 722-24, below).

722. Kronos, in a September 2017 Public Investor Presentation, advised investors that "[h]igher concentration increases likelihood of continued capacity constraints." It described the higher concentration, therefore, to be a part of the industry "[s]tructural improvements" that would lead to increased earnings. (PX3011 at 38 (Kronos presentation); Christian, Tr. 772 ("Higher concentration" means "less players in the industry" and "capacity constraints" means "that the capacity constraints already existed at the time in the industry, and these potential -- and in some cases these consolidations that we were seeing -- we think further increase the likelihood that those constraints would be present for a longer period of time.")).

723. Venator, in a June 2017 investor presentation prepared in connection with the Initial Public Offering for the TiO2 business, projected that the acquisition would {[redacted]} (PX3000 at 004 (Venator presentation) (*in camera*)).

724. About a month later, a Venator July 2017 Analyst Day presentation by Venator's Chairman, Peter Huntsman, and President, Simon Turner, [redacted]

[redacted] (PX3054 at 14 (Venator presentation) (*in camera*)). [redacted] (PX3054 at 19 (Venator presentation) (*in camera*)).

725. Referring to the testimony of market participants – customers and competitors – with respect to the effects of the merger, Dr. Hill described how this testimony regarding competitive effects "reinforces my conclusions." (Hill, Tr. 1895-96)

726. Dr. Hill described customer testimony in which the "the general concerns are that it will likely lead to increased withholding of output and a higher market price." (Hill, Tr. 1896; PX5000 at 107 (¶250) (Hill Initial Report) (discussing deposition testimony of several customers and concluding that "[w]hile rivals of Tronox and Cristal view the deal positively, some of Tronox and Cristal's customers are concerned by it.") (*in camera*); *see also* Malichky, Tr. 615 ([redacted]) (*in camera*)).

727. Dr. Hill also observed that "a number of statements from competitors . . . indicate that they believe the transaction is likely to lead to increased output withholding and higher prices." (Hill, Tr. 1896-97; PX5000 at 107 (¶249) (Hill Initial Report) (describing ordinary course documents and public statement of competitors and concluding that "[c]ompetitors state that increased consolidation will increase profitability.") (*in camera*)).

VI. ENTRY AND EXPANSION

728. Entry or expansion into the market for the sale of chloride TiO2 to North American customers will not be timely, likely, or sufficient to offset the anticompetitive effects of the merger. (*See* PX9085 at 028-29 (Horizontal Merger Guidelines, §§ 9.1-9.3)). First, entry or expansion into the mature North American chloride TiO2 market is expensive and takes a significant amount of time. (*See* CCFF ¶¶ 729-44, below). Second, the prospect of increased imports of chloride TiO2 into North America from China or elsewhere is highly uncertain and speculative, and also unlikely to alleviate potential anticompetitive effects from the merger. (*See* CCFF ¶¶ 745-812, below).

A. Entry or Expansion by Building a New Plant in North America Would Not Be Timely, Likely or Sufficient to Deter or Counteract the Merger's Anticompetitive Effects

729. Under the Horizontal Merger Guidelines the, "Agencies consider the actual history of entry into the relevant market and give substantial weight to this evidence." (PX9085 at 027-29 (Horizontal Merger Guidelines, § 9)). The record evidence is clear that there has been no new TiO2 entry in North America for many years. (PX1650 at 018 (Tronox Presentation) ({[redacted]}) (*in camera*); PX9119 at 006 (Tronox investor call transcript) (No new chloride TiO2 plant put into commercial production since 1994.)). There is no evidence of any large-scale output expansions by North American producers even when North American chloride TiO2 prices exceeded $4,000 per ton in 2012. (PX9020 at 040 (Chemical Economics Handbook); PX1532 at 153 (TZMI Cost Study); PX5000 at 064, 111-12 (¶¶ 256-57 & Figs. 24, 38) (Hill Initial Report) (*in camera*)).

730. According to a 2017 TZMI report, **{** [redacted] **}** (PX1663 at 030 (TZMI, presentation) (*in camera*); PX3038 at 050 ({ [redacted] }) ({ [redacted] }) (*in camera*)). Tronox similarly **{** [redacted] **}** (PX0017 at 033 (Tronox Response to FTC Request for Additional Information) (*in camera*)).

731. The reasons for the absence of entry are clear: there are significant and costly hurdles to entering the chloride TiO2 market. **{** [redacted] **}** (PX3038 at 022 ({ [redacted] }) (*in camera*)).

732. Tronox and Cristal agree with **{** [redacted] **}** that the capital costs of constructing a new chloride titanium dioxide plant are very high. (PX9119 at 003 (Tronox investor call transcript) ("the capital costs for a new chloride plant are very high and therefore, the

capital risk associated with decision is not insignificant.")). Recently, Tronox estimated the cost of constructing such a new plant in the United States as ranging from **{** **}** (PX0017 at 033-34 (Tronox Response to FTC Request for Additional Information) (*in camera*); PX5000 at 108-09 (¶ 253) (Hill Initial Report) (*in camera*)). Cristal similarly estimated that building a new plant in the United States would cost **{** **}** (PX0002 at 067 (Cristal Second Request Response) (*in camera*)).

733. Entry into the North American TiO2 market is unlikely under current market conditions—or even after a price increase resulting from the merger—because the likely returns on the investment do not justify the investment required to build new chloride TiO2 plants in North America. (*See* CCFF ¶¶ 734-36, below).

734. **{** **}** (PX1091 at 035, 084 (Tronox TiO2 Strategic Plan 2017) (*in camera*)). Similarly, in a 2017 presentation, Venator estimated that TiO2 prices would need to reach price levels of **}** to make adding new TiO2 production capacity economical. (PX3035 at 025 (Venator Analyst Day) (*in camera*)).

735. In a recent investor presentation, Kronos stated that "at current pricing structure, capacity increases would yield a negative IRR {internal rate of return} with a significant payback

period." It concluded that a price and margin improvement of about $1,000 per metric ton would be "required to justify reinvestment" and shared that there were no announced plant expansion projects in North America (PX3011 at 015, 027) (Kronos Public Investor Presentation); PX3038 at 022 ({ }) ({ }) (*in camera*)).

736. The potential impact on prices of adding additional chloride TiO2 capacity to the North American market further reduces the likelihood of entry or expansion, especially by the major North American TiO2 producers who would most benefit from the higher TiO2 resulting from the merger. (PX7036 (Keegel, Dep. at 170) ({ }) (*in camera*); PX1091 at 084 (Tronox presentation) (with respect to greenfield entry, { } (*in camera*)).

737. Capacity expansion at an existing chloride TiO2 plant, which could increase a plant's output by adding a new line, is also costly. (Christian, Tr. 764). Kronos estimates that such an effort could cost upwards of $200 million. (PX3007 at 014 (Kronos presentation)). Cristal estimates it would cost { } (PX0002 at 067 (Cristal Response to FTC Request for Additional Information) (*in camera*)).

738. Although TiO2 producers have actively engaged over the years in debottlenecking to increase their production of TiO2, there are limits to debottlenecking, including the physical size of the plant, technology, and permitting. (Christian, Tr. 761-62; *see also* Hill, Tr. 1864-65 (Incremental increases like debottlenecking is usually absorbed by increases in demand.)). More importantly, most of the potential debottlenecking has already occurred over the last 15-20 years, so it is unlikely to have an effect on the market. (Christian, Tr. 761-62 ("a lot of the debottlenecking has already taken place over the last 15, 20 years")).

739. In addition to high costs, constructing a new chloride TiO2 plant is a lengthy process that typically requires at least four to five years, rendering such efforts untimely. For example, Tronox estimates that entry into the manufacture of chloride TiO2 would **{** [redacted] **}** (PX0003 at 034 (Tronox Response to FTC Request for Additional Information) (*in camera*); PX1636 at 001 (Romano email to Arndt) ("Four years for a greenfield plant would be aggressive. . . Total time line would be 54 months or 4.5 years if everything went according to plan (aggressive)."); Romano, Tr. 2138-39 (agreeing that "aggressive" means "faster than you would expect")).

740. Other TiO2 producers have similar views regarding the lengthy time required to build a new chloride TiO2 plant. PX0002 at 067 (Cristal Narrative Response, Response to Specification 13) ({ [redacted] }) (*in camera*); PX3007 at 014 (Kronos Presentation); Christian, Tr. 765 ("[Y]ou would have to get permitting both from a manufacturing standpoint and an environmental standpoint, and then you have to invest a

significant amount of capital to actually build a TiO2 plant. You know, they're not available for sale, you know, off the shelf. It's a completely engineered and a slow process that's individual to each producer's technology. They take a long time to build."); PX3037 at 003 ({ [redacted] }) (*in camera*); Hill, Tr. 1869-70; PX5000 at 107 (¶ 251) (Hill Initial Report) (*in camera*); PX3035 at 025 (Venator presentation) ({ [redacted] }) (i*n camera*)).

741. Even after expending the cost and time required to design, build, and bring a new chloride TiO2 plant on-line, many customers would then need to qualify the TiO2 grades produced by the new plant. (*See* CCFF ¶¶ 748-54, below). This process can be quite lengthy, and the qualification process **{** [redacted] **}** (PX8000 at 003 (¶ 13) (Malichky Decl.) (*in camera*); PX8006 at 002 (¶ 11) (Pschaidt Decl.) (*in camera*); PX8003 at 004 (¶¶ 17-20) (Young Decl.) ({ [redacted] }) (*in camera*)). This makes it even less likely entry will be a timely or effective deterrent against anticompetitive effects. (PX5000 at 116 (¶266) (Hill Initial Report) ("To be considered timely enough to offset anticompetitive effects, entry must be able to occur quickly enough to render the actions that cause those effects unprofitable, even though such effects would be profitable until entry occurred.") (*in camera*)).

742. In addition to the cost and timing of constructing a chloride TiO2 plant, chloride TiO2 producers also view intellectual property as a significant hurdle to entering the chloride TiO2 market from a technology and know-how standpoint. While the major North American chloride TiO2 producers already have access to the relevant intellectual property and know-how, potential new entrants, including the Chinese producers, do not, further limiting potential entry to market for the sale of chloride TiO2 to North American

customers. (PX1000 at 018 (Tronox presentation) ({ }) (*in camera*)); PX2055 at 025 (Cristal presentation) ({ }) (*in camera*)).

743. As Tronox's then-CEO, Mr. Casey, explained in a 2012 earnings call, "We think that the intellectual property, particularly with respect to the know-how about how to operate these plants, is very difficult to come by." (PX9119 at 005 (Tronox investor call transcript)). Further, ordinary course documents of both Respondents assert that the proprietary technology needed to operate a chloride plant creates barriers to entry into chloride process TiO2. (PX1001 at 014 (Tronox Confidential Information Memorandum) ("[P]roprietary technology, operating expertise and worldwide patents require technical sophistication and a highly skilled workforce that cannot be easily replicated by new entrants."); PX9033 at 002-03 (Tronox Earnings Call) ("In addition, running TiO2 plants is a capital-intensive undertaking that requires mastery of complex, proprietary technology, and which remains a major hurdle particularly for the chloride process production plants."); PX0003 at 034 (Tronox Response to FTC Request for Additional Information) ({ }) (*in camera*); Hill, Tr. 1867-68)).

744. Brian Christian, Executive Vice-President at Kronos, likewise emphasized that the technology to operate a chloride TiO2 plant "is one of the critical barriers to entry to the industry. It's highly customized and bespoke, and it's a critical aspect of [Kronos']

business. [Kronos] do[es] everything we can to protect it." (Christian, Tr. 789; PX3011 at 013, 019, 027 (Kronos presentation) ("High barriers to entry for chloride process TiO2 capacity . . . . Chloride process technology is closely held by the major producers."); (PX3038 at 022 ({ [redacted] }) (*in camera*)).

B. Entry or Expansion by Chinese Producers Would Not Be Timely, Likely, or Sufficient to Deter or Counteract the Likely Anticompetitive Effects from the Merger

745. TiO2 from Chinese producers is not a meaningful competitive constraint in North America. (PX9001 at 009 (Tronox Q3 2016 Earnings Call) ("So the question for us is, do we confront China-produced supply in the market as a competitive alternative to our supply. And as I've said, we don't. . . . [T]he kind of customers that will buy our high-quality pigments are not simultaneously looking at for the same supply need Chinese product."); PX9006 at 006 (Tronox Q2 2015 Earnings Call) ("We do not see that exports from China or from Europe are playing a material role in the competitive balance in the North American market."); PX9010 at 010 (Tronox Q2 2014 Earnings Call) (Chinese TiO2 producers have thus far failed to establish themselves as a "material competitive presence, either in terms of volume or in terms of price. That implies to [Tronox] that it's staying pretty much within the Chinese or the Asian market. I think a lot of supply generally from China generally tends to go into Latin America, then into the Middle East. It's simply not a major force in our markets."); PX7037 (Pickett, Dep. at 58-59) (Cristal's GM for Sales in the Americas { [redacted] }) (*in camera*); PX4020 at 001 ({ [redacted] }) (*in camera*); PX8004 at

002-03 (¶ 9) (O'Sullivan Decl.) ({ }) (*in camera*)).

746. This would not change with the merger as imports of TiO2 from China, including both sulfate and chloride TiO2, would not offset the anticompetitive impact from the proposed merger. (*See* CCFF ¶¶ 747-807, below).

i. Imported Chinese Chloride TiO2 Would Not Offset Likely Anticompetitive Effects in the Relevant Market for Sale of Chloride TiO2 to North American Customers

747. Imports of chloride TiO2 to North America will not offset the anticompetitive effect of the merger for several reasons: (1) Chinese chloride TiO2 does not meet the standards that North American customers require; (2) Chinese producers lack the technology and know-how to successfully operate chloride TiO2 plants; (3) there is no cost advantage to manufacturing chloride TiO2 in China; (4) North American customers are unlikely to benefit from Chinese chloride TiO2 production because of lack of available supply; (5) import costs, duties and other logistical issues present additional huddles for increasing imports of chloride TiO2 from China; and (6) the supposed expansion by Lomon Billions is speculative, years away, and unlikely to prevent any anticompetitive effects from the merger. (*See* CCFF ¶¶ 748-807, below).

(a) Chinese chloride TiO2 does not meet the standards North American customers require

748. Customers in North America have strict quality requirements for their TiO2 and strict requirements for their suppliers, including strong reliability standards. (*See* CCFF Section III.A.i., ¶¶ 26-133, above).

749. Chinese chloride TiO2 lacks the requisite quality that customers in North America require. Chloride TiO2 from Chinese producers, including **{** **}**, has not passed the qualification requirements set by several North American customers, to even be considered as a potential source of supply. **{** **}** (PX8003 at 005 (¶ 23) (Young Decl.) (*in camera*); Young, Tr. 683, 686 (Chinese manufactured TiO2 **{** **}**) (*in camera*)). **{** **}** (PX8000 at 004-05 (¶ 20) (Malichky, Decl.) (*in camera*); Vanderpool, Tr. 202-03 (**{** **}**) (*in camera*); Vanderpool, Tr. 251 (qualification takes a long time – **{** **}**) (*in camera*); PX7044 (Vanderpool, Dep. at 101-02) (*in camera*); Pschaidt, Tr. 986-87 (**{** **}**) (*in camera*); *see* RX1198 at 0067 (TZMI Presentation) ("Exports from China primarily serve emerging economies where product quality is a better fit for the customer base in those

regions.")). Mr. Arrowood from Deceuninck stated that Deceuninck would import TiO2 from China only as a "last resort." (Deceuninck, Tr. 1094-95)

750. North American TiO2 producers also believe that the quality of Chinese chloride TiO2 is {[redacted]} as Venator's recent investor presentation described {[redacted]} (PX3035 at 025 (Venator Presentation) (*in camera*)).

751. Mr. Christian of Kronos similarly observed that chloride TiO2 from China has continued to be lower quality. (Christian, Tr. 797 ("We just don't see Chinese chloride in the markets in which we compete. I think the extremely minimal amount of Chinese [chloride TiO2] product stays in lower and goes into lower quality products.")).

752. According to Sherwin-Williams, {[redacted]} (PX4020 at 001 (Sherwin-Williams document) ({[redacted]}) (*in camera*)).

753. Moreover, {[redacted]} (PX7016 (DeCastro, Dep. at 92-95) (*in camera*); PX8000 at 004-05 (¶¶ 20-22) (Malichky Decl.) ({[redacted]}) (*in camera*); PX8003 at 005 (¶¶ 23-24) (Young Decl.) ({[redacted]}

[redacted]}) (*in camera*); Pschaidt, Tr. 986-87 (*in camera*); PX7027 (Pschaidt, Dep. at 137-38) (*in camera*); PX8006 at 003 (¶ 16) (Pschaidt Decl.) ({[redacted]}) (*in camera*); PX8001 at 003 (¶ 14) (Zamec Decl.) (*in camera*)).

754. {[redacted]} (PX8000 at 004 (¶ 17) (Malichky Decl.) (*in camera*); Pschaidt, Tr. 986-87 (*in camera*); PX7027 (Pschaidt, Dep. at 62-63) ({[redacted]}) (*in camera*)).

(b) No Chinese producer is currently supplying chloride TiO2 to North American customers in significant volume in part because of technology issues and lack of know-how

755. Imports of chloride TiO2 from all producers in China account for {[redacted]} of the North American market for chloride TiO2. (PX5000 at 067-68 (¶ 152 & Fig. 25) (Hill Initial Report) (*in camera*)).

756. According to a Tronox strategic plan, {[redacted]} (PX1036 at 006 (Tronox Presentation) (*in camera*); PX1033 at 002 (Tan email to Engle) ({[redacted]}

[redacted]

[redacted]}) (*in camera*)). In November 2016, Tronox observed that **{**[redacted]**}** (PX1006 at 015 (Tronox presentation) (*in camera*)).

757. Chinese TiO2 producers have struggled to produce chloride TiO2. Tronox has identified several reasons accounting for those struggles, including: **{**[redacted]**}** (PX1000 at 018 (2016 Tronox Strategy Document) (*in camera*); PX1012 at 005 (Tronox presentation) (*in camera*) ({[redacted]}); PX1062 at 009-11 (Tronox presentation); PX1067 at 001 (Engle email to Larson) ("They have no idea what they are doing."); PX1387 at 002 (Keegel email to Merturi) ({[redacted]}) (*in camera*); PX1399 (Tronox "Fireside Chat" Q&A) ({[redacted]}) (*in camera*)).

758. As Tronox concluded, **{** **}** (PX1003 at 023 (Tronox presentation) (**{** **}**) (*in camera*); PX1036 at 006 (Tronox presentation) (**{** **}**) (*in camera*)).

759. Chinese producers struggle to produce chloride TiO2 in part because of the "[s]uperior chloride process technology closely guarded by Western producers." (PX3011 at 019 (Kronos presentation); *see* CCFF ¶¶ 742-44, above).

760. Other North American TiO2 producers have also observed that **}** (PX2055 at 025 (Cristal presentation) (*in camera*)). **{** **}** (Christian, Tr. 808-10 (discussing

Lomon Billions' announced expansion: **{** [redacted] **}**) (*in camera*); PX7035 (Christian, Dep. at 227) (**{** [redacted] **}**) (*in camera*); PX8002 at 005 (¶ 22) (Christian Decl.) (**{** [redacted] **}**) (*in camera*)).

761. Based on all of these issues, Tronox concluded that **{** [redacted] **}** (PX1401 at 002 (Tronox presentation) (*in camera*)).

762. Several other major TiO2 producers agree with Tronox about the state of development of chloride TiO2 production in China. **{** [redacted]

[redacted] } (PX8004 at 002-03 (¶ 9) (O'Sullivan Decl.) (*in camera*)). Kronos does { [redacted] } (PX8002 at 006 (¶ 24) (Christian Decl.) (*in camera*)).

763. In response to [redacted] Cristal stated that { [redacted] } (PX2073 at 012 ({ [redacted] }) (*in camera*)).

764. In July 2017, Venator, who has first-hand experience with Lomon Billions through a licensing arrangement for a single grade of TiO2 to resolve competition concerns in Europe, gave an investor presentation stating: { [redacted] } (PX3027 at 024 (Venator presentation) ({ [redacted] }) (*in camera*)).

765. { [redacted]

[redacted] (PX3035 at 020, 025 (Venator presentation) (*in camera*)).

(c) There is no cost advantage to manufacturing chloride TiO2 in China

766. The evidence demonstrates that the Chinese producers cannot manufacture chloride TiO2 at a low enough cost to overcome transportation costs and duties to counter price increases to North American customers resulting from the merger. (*See* CCFF ¶¶ 767-74, below).

767. At the end of 2015, Tronox's Mr. Engle, who had observed to his colleagues that [redacted] estimated that [redacted] (PX1068 at 001-02 (Engle email) (*in camera*)).

768. According to a 2015 TiO2 producer cost study published by TZMI, the CITIC Jinzhou plant in China is the highest cost of the 21 chloride TiO2 plants identified in the study. (RX0105 at 072 (TZMI presentation)). These higher costs are attributable to higher utility costs and higher fixed costs due to the lack of scale. (RX0105 at 141 (TZMI presentation)).

769. TZMI's 2016 Producer Cost Study, [redacted]

[redacted] } (PX1663 at 149 (TZMI presentation) (*in camera*); PX1663 at 133-53 (TZMI presentation) ({ [redacted] }) (*in camera*)).

770. Unlike sulfate TiO2, chloride TiO2 manufacturing is not a low labor cost process, a factor that erodes one source of potential cost advantage for manufacturing TiO2 in China. (PX3011 at 019 (Kronos presentation) ("Benefits of production in China such as low labor and environmental costs not applicable to chloride technology."); Christian, Tr. 796 ("[C]heap labor and relaxed environmental standards" are not applicable to chloride TiO2 as opposed to sulfate TiO2 because "because [the latter is] much more labor-intensive and it generates a significant amount of waste or byproducts per ton of TiO2…. So when you think about China as a potential competitor, a lot of their historic, perceived advantages over the western world just don't exist or at least aren't overly material in comparison to western producers.")).

771. In recent years, manufacturing costs in China have also increased due to pressures on TiO2 feedstock availability and costs. { [redacted]

[redacted] (PX1268 at 001 (Van Niekerk email to Keegel) ([redacted]) (*in camera*); PX1266 at 001 (Van Niekerk email to Turgeon) ("Iron ore prices have declined to such a point that its production is cut back and as a result ilmenite as byproduct will becomes scarce. Once inventories on the east coast dwindles, I expect an increase in ilmenite prices."); PX1265 at 001 (Van Niekerk email to Romano) ("I think one can read into this that ilmenite in China is getting very tight."); PX1385 at 001 (Engle email to Tronox sales force) ([redacted]) (*in camera*); PX1387 at 002 (Keegel email to Merturi) ([redacted]) (*in camera*)).

772. Other chloride TiO2 producers have also highlighted the increasing feedstock costs in China. (PX3027at 009 (Venator presentation) ([redacted]) (*in camera*); PX3011 at 019 (Kronos presentation) ("CP production depends on ore imports to service existing capacity"); PX8002 at 005 (¶ 21) (Christian Decl.) ([redacted]) (*in camera*)).

773. Further, manufacturing costs in China have increased due to the costs of complying with environmental and other government regulations. (PX5002 at 020 (¶ 41) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*)). Tronox has emphasized these continuing

cost pressures publicly in recent lender and investor presentations. For example, Tronox in September 2017, stated to a lender that there were the several {[redacted]} (PX1437 at 019 (Tronox presentation) (*in camera*); PX1438 at 019 (Tronox presentation) (*in camera*); Christian, Tr. 798-99 ("But then they also made the existing suppliers put in improved pieces of equipment, whether it's a desulfurization unit or some sort of environmental equipment that just adds cost to the product, but does not actually change the quality of the product, so their cost structure increase."); Turgeon, Tr. 2727).

774. In 2017, Venator made similar points to its investors, addressing the range of factors contributing to increasing costs associated with TiO2 manufacture in China. (PX3027 at 003 (Venator presentation) ({[redacted]}) (*in camera*)).

(d) Local Chinese demand for chloride TiO2 is increasing and there are limits on availability of chloride TiO2 from China

775. Domestic demand for Chinese chloride TiO2 is growing faster than supply, making it unlikely that there will be an increase in Chinese imports into North America. (*See* CCFF ¶¶ 776-80, below; Hill, Tr. 1879).

776. {[redacted]} (PX0011 at 036 (Tronox board of directors and committee meetings) (*in camera*)). In November 2016, Tronox

told its Board this very fact: {[redacted]} (PX0011 at 036 (Tronox board of directors and committee meetings) (*in camera*); PX1193 at 001 (Keegel email to Casey) ({[redacted]}) (*in camera*); RX1198 at 0046 (TZMI presentation) (Chinese "capacity changes from 2018-2021 are expected to net far less supply than is required to meet the additional demand."); Hill, Tr. 1877-78; PX5002 at 019 (¶ 39 & Fig. 5) (Hill Rebuttal Report to Stern and Imburgia) (citing TZMI, "Pigment Supply Demand") (*in camera*)).

777. The growth in demand for chloride TiO2 in China will likely exceed overall TiO2 demand, since chloride TiO2 will continue to replace sulfate TiO2 in China, in part due to Chinese government emphasis on the development of the chloride TiO2. (PX3027 at 023 (Venator presentation) ({[redacted]}) (*in camera*)). TZMI estimates that China's share of global TiO2 demand is rapidly increasing from "4% of global demand in 2005" to an estimated "27% in 2020." (PX1532 at 040 (TZMI presentation); PX8002 at 005 (¶ 21) (Christian Decl.) ({[redacted]}) (*in camera*); PX3032 at 001-02 (Ogden email to Huntsman with attachment) (noting "Chinese TiO2 growth is primarily feeding local and Asian demand" and attaching "one of the better analyst reports" regarding Chinese TiO2 manufacturing with a report describing how Chinese "government policy appears tilted towards limiting investment into new/expansion of sulfate-based technology for environmental reasons.").

778. Additionally, it is **{** [redacted] **}** (PX7000 (Snider, IHT at 132-33) (*in camera*); PX8000 at 005 (¶ 22) (Malichky Decl.) (Chinese producers **{** [redacted] **}**) (*in camera*); PX7016 (DeCastro, Dep. at 90) (**{** [redacted] **}**) (*in camera*)).

779. Overall, Chinese TiO2 capacity has declined over the last several years due to increasing environmental regulation and enforcement. (PX2072 at 023 (Cristal presentation) (10-15 plants idled, many expected to close, and others expected to close due to environmental issues); PX9001 at 006 (Tronox Q3 2016 Earnings Call) (observing that net Chinese production was down in 2015 and would be down again in 2016 and 2017); PX9002 at 007 (Tronox Q2 2016 Earnings Call) (estimating that approximately 400,000 metric tons of capacity could be reduced in China because of regulation); PX8002 at 001 (¶ 21) (Christian Decl.) (**{** [redacted] **}**) (*in camera*); Young, Tr. 685 (**{** [redacted] **}**) (*in camera*); PX7025 (Malichky, Dep. at 231) (**{** [redacted]

[redacted]

[redacted]}) (*in camera*)).

780. Tronox described the reduced production in China in its third quarter 2016 earnings call: "In the longer term, we look at the various additions and subtractions of production in China….[N]et of both additions and withdrawals or closures, it was down last year. It's going to be down this year, and it's going to be down next year…. As demand grows domestically, more and more supply will go into the domestic market, which means less will be available for the export market, and Chinese share in the global market we think is going to decline over the next several years." (PX9001 at 009 (Tronox Q3 2016 Earnings Call); *see also* PX1006 at 015 (Tronox Presentation) **("{**[redacted]**}**") (*in camera*); PX1004 at 005 (Tronox Presentation) (*in camera*); PX1641 at 001 (Casey email to Arndt with a forwarded note) (Mr. Casey describing "This is a very good note - data based and comprehensive," and the note observing "Chinese producer Yunnan Xinli noted government policies aimed at consolidating the industry will reduce the producer base in China from 42 companies in 2015 to fewer than 20 by 2020. While China exports have ticked up this year, they remain a small share of Western markets."); PX1395 (Tronox investor draft Q&As) at 008)).

781. Venator also believes that [redacted] For example, a [redacted]**}**

(PX3027, at 022 (Venator presentation) {([redacted]}) (*in camera*); (PX7015 (Maiter, Dep. at 212-13) ({[redacted]}) (*in camera*)). In reaching that conclusion, Venator relied in part on a TiO2 industry report in coming to this conclusion: {[redacted]} (PX3027 at 008 (Venator presentation) (*in camera*); PX3004 at 001 (Venator document) (summarizing "Highlights from 2017 CCM reports describing capacity moderation/issues" describing "supply-side reform in the past two years which eliminated 360ktpa of outdated capacity" and further projected that about 20% of the capacity in China, about 690 ktpa of small scale capacity of less than 50ktpa would also be eliminated)).

782. A few months after the Venator investor presentation, Mr. Turgeon of Tronox made a presentation at the September 2017 RBC Global Industrials Conference where he described {[redacted]} (RX0981 at 013, 016 (Tronox presentation) (*in camera*)).

783. Kronos in its September 2017 investor presentation also described increased rationalization among TiO2 producers in China: "China continuing to rationalize

capacity as government drives environmental improvements." (PX3011 at 038 (Kronos presentation)). This was among the factors, along with the capacity reductions and industry structural improvements, that Kronos described to its investors would drive increased EBITDA for Kronos. (PX3011 at 038 (Kronos presentation)).

784. Further, as the overall availability of TiO2 has diminished, the price of TiO2 in China has increased quite dramatically in recent years. In a May 2017 investor call, Tom Casey estimated that through Q1 of 2017, prices for Chinese TiO2 increased by 65% for domestic sales and 45% for export sales since the start of 2016 alone, due to the reduced capacity for pigment, as well as reduced availability and higher costs of feedstocks in China. (PX9028 at 004 (Tronox Q1 2017 Earnings Call); see also PX1061 at 005 (Tronox presentation) (showing increasing Chinese export prices since the beginning of 2016); PX1395 at 008 (Tronox investor draft Q&As) ("Chinese pigment producers continue to raise domestic and export selling prices. Since the start of [2016], we have seen 11 price increase announcements made by Chinese TiO2 producers, essentially one per month. Chinese domestic selling prices offered on a delivered basis are up 15-20% YTD. In export markets, selling prices offered on a CIF basis are also up 15-20% YTD.")).

785. Those Chinese prices have continued to increase in 2017. (PX9099 at 007 (Tronox Q3 2017 earnings call) ("[W]e feel very comfortable today that the Chinese price have [sic] moved in the same range as our price."); PX7001 (Romano, IHT at 229) (discussing [redacted]}) (*in camera*); PX1619 at 016, 019 (Tronox TiO2 Variance Analysis) (indicating that TiO2

[redacted]) (*in camera*); PX8003 at 005 (¶ 24) (Young Decl.); PX7025 (Malichky, Dep. at 230) ({[redacted]}) (*in camera*)).

786. With reduced availability and higher TiO2 prices in Asia, overall TiO2 imports into North America from China have declined. For example, Tronox's Monthly China Trade Report from October 2017 showed that from October 2016 through September 2017, China's TiO2 exports to the U.S. decreased by 19% from their already small amount. (PX1538 at 004 (Tronox presentation); PX7021 (McGuire, Dep. at 101) (discussing PX1538: **{**[redacted]**}**) (*in camera*); *see* PX1395 at 008 (Arndt email) **({**[redacted]}) (*in camera*); PX3027 at 014 (Venator presentation) (Chinese "Net exports flat" based on information through May 2017); PX3054 at 091 (Venator presentation) ({[redacted]

[redacted]}); PX1570 at 007 (TZMI Presentation) (showing overall imports of TiO2 from China to be 10% lower in Q1 2017 than in Q1 2015); RX1198 at 0072 (TZMI Presentation) (level of TiO2 exports from China to North America in first half of 2017 below exports levels for first half of both 2015 and 2016)).

787. {[redacted]} (PX7052 (O'Sullivan, Dep at 043) ({[redacted]}) (*in camera*)).

788. Similarly, Mr. Christian of Kronos testified that the {[redacted]} (Christian, Tr. 814-15 (*in camera*)).

(e) Import costs and other logistical issues present additional hurdles for increasing imports of chloride TiO2 from China

789. Costs and logistical issues make it unlikely that Chinese producers will increase exports of chloride TiO2 to North America. (CCFF ¶¶ 810-813). Duties to import chloride TiO2 into North America are around {[redacted]}. (PX7050 (Mei, Dep. at 081-82, 112-13) ({[redacted]}) (*in camera*); *see also* Duvekot, Tr. 1303-05 (*in camera*)). {[redacted]} (Malichky, Tr. 318 ({[redacted]}

[redacted]**}**) (*in camera*); PX7016 (DeCastro, Dep. at 64-65) ([redacted]**}**) (*in camera*); PX7050 (Mei, Dep. at 112-13) (*in camera*)). Moreover, the duty for importing TiO2 from China—for example, from Lomon Billions—could go up if the administration chooses to raise the duty. (PX7028 (Duenwald, Dep. at 142-43)).

790. A producer from China would also face the cost of maintaining storage to meet the needs of customers who require regular on-time delivery. (PX7054 (O'Malley Noe, Dep. at 111-12) ("What we do is if we bring material over it's put in the third-party warehouse, and then customers would receive it from the warehouse, if that's what you mean by storing it.")).

791. Shipping from China also adds significant delay in receiving the TiO2. According to Ms. O'Malley Noe of Billions America, shipping from China adds at least four weeks of lead time, and can be longer depending on a variety of factors such as "issues with the ports in China." (PX7054 (O'Malley Noe, Dep. at 113)). These shipping delays have occurred "relatively often" over the last two years, causing delays in deliveries to customers. (PX7054 (O'Malley Noe, Dep. at 108, 113); Young, Tr. 671 (advantages of local sourcing are **{**[redacted]**}**) (*in camera*)).

792. {[redacted]} and quality issues cause customers to have concerns about the reliability of Chinese TiO2 producers. (PX7016 (DeCastro, Dep. at 93) ({[redacted]}) (*in camera*)). {[redacted]} because when procuring TiO2, a key input to the customers' products, {[redacted]} (PX7025 (Malichky, Dep. at 081-82) ({[redacted]}) (*in camera*); PX7044 (Vanderpool, Dep. at 21) (product quality, pricing, availability and service level are key factors with sourcing TiO2); PX7016 (DeCastro, Dep. at 47) ({[redacted]}) (*in camera*); (Christian, Tr. at 784) (North American customers have "extremely high demands" for on time delivery of TiO2 that consistently meets their quality specifications)).

793. Reliability of supply is especially important for customers buying slurry TiO2, which cannot be stockpiled for long in the customers' inventory. (PX7035 (Christian, Dep. at 185) ({[redacted]}) (*in camera*)). For these customers, when they no longer have a supply of TiO2, they must shut down their plants. (PX7025 (Malichky, Dep. at 12); Christian, Tr. at 785-86 (customers buying slurry store less inventory and do not have "a lot of cushion" if a supplier is unreliable)).

(f) Chloride TiO2 expansion by Lomon Billions will not deter or counteract the likely anticompetitive effects in North America

794. The Respondents single out Chinese TiO2 producer Lomon Billions as particularly likely to provide a competitive constraint on their North American chloride TiO2 business.

(Respondents' Pre-Trial Brief, at 43) ("In short, Chinese TiO2 producers, particularly Lomon Billions, pose a credible, growing threat to TiO2 producers in North America"). Specifically, Respondents point to Lomon Billion's announcement of plants to expand chloride TiO2 production capacity at its plant in Jiaozuo, Henan Province, China by 200,000 tons by 2020. (RX0195 at 001-02) (Lomon Billions Press Release)).

795. Tronox, however, has explained to investors that, even considering the potential expansion of Lomon Billion's chloride TiO2 capacity at the Jiaozuo plant, it does not expect the expansion to have any impact on "market dynamics" because it will be absorbed by rising demand. (PX9101 at 008 (Q4 2017 Tronox earnings call) ("Jeffry N. Quinn: Yes, I think we're seeing all the incremental expansion over the next 18 to 24 months, will really kind of just be soaked up by the incremental global growth. So we don't see that, that incremental expansion will significantly change the current dynamics. John D. Romano: At 6.2 million tonnes of current demand – 200,000 tonnes is about 3% growth and that's what you need to support it."); Quinn, Tr. 2410-11 (discussing PX9101) (Lomon's possible chloride expansion would "would sort of balance the incremental, you know, global growth.")). Mr. Turgeon also testified to what he described as expected "flat production in China," considering the mix of plants being closed and debottlenecking of other plants. (Turgeon, Tr. 2704). TZMI projects that even accounting for the announced Billions expansion, "[t]he capacity changes from 2019-2022 are expected to net far less supply than is required to meet the additional demand." (RX1197 at 46 (TZMI presentation); *see* RX1197 at 11 (TZMI presentation) ("Lomon Billions formally announced a significant expansion, slated for 2019-20")).

796. Consistent with the testimony of Mr. Quinn and Mr. Turgeon, and based on his review of documents and industry reports such as the TZMI report, Dr. Hill concluded that the announced Lomon Billions expansion would not affect his opinions regarding the impact of Chinese expansion, due to the fact that the expansion, even were it to occur, "will likely be absorbed by growth in demand in the Asia-Pacific region." (Hill, Tr. 1881).

797. The new Lomon Billions plant is unlikely to have an impact on North American customers for the following reasons: (1) Lomon Billions has virtually no **{** **}** (2) Lomon Billions has **{** **}** (3) Lomon Billions has not been successful with its current chloride TiO2 plant; (4) Lomon Billions has an unrealistic timeframe for constructing its new plant; and (5) the potential impact is highly speculative. (*See* CCFF ¶¶ 798-807, below).

798. Lomon Billions has two employees in North America, with access to a third-party operated warehouse to maintain its limited TiO2 inventory. (PX7054 (O'Malley Noe, Dep. at 112) (Billions has one warehouse in Gary, Indiana). It offers one grade of chloride TiO2 (PX7054 (O'Malley Noe, Dep. at 19-20), and its sales of chloride TiO2 in the U.S. in 2017 was approximately 3,000-4,000 tonnes, which is less than **{** **}** of the North American chloride TiO2 sales. (PX7054 (O'Malley Noe, Dep. at 102); *see* PX5000 at 067-68 (¶152 & Fig. 25) (Hill Initial Report) (*in camera*)).

799. Lomon Billions has a limited infrastructure in place to supply customers in North America and does not **{** **}** (Malichky, Tr. 317 ({

[redacted]**}**) (*in camera*); Malichky, Tr. 607 ({[redacted]**}**) (*in camera*)).

800. Further, Lomon Billions does not have the sort of local sales and service infrastructure comparable to what the other North American producers maintain. (PX7054 (O'Malley Noe, Dep. at 065) (Billions America provides no technical service to customers); PX9104 at 010 (Tronox 10-K) ("Due to the technical requirements of TiO2 applications, our technical service organization and direct sales offices are supported by a regional customer service staff located in each of our major geographic markets."); Engle, Tr. 2536-37 (describing technical service to be an important part of Tronox's value proposition to customers)).

801. Lomon Billions does not have a successful record in running chloride TiO2 plants, making it even less likely that the proposed expansion will have an impact on North American customers. (PX7054 (O'Malley Noe, Dep. at 124) ; Engle, Tr. 2492; Quinn, Tr. 2412)). The 100,000 kilotons per annum plant that Lomon Billions made operational in 2015 has never achieved its nameplate capacity and continues to operate at a capacity of just 60,000 tons per year of TiO2. (PX7054 (O'Malley Noe, Dep. at 124); Engle, Tr. 2492; Quinn, Tr. 2412 ("I know that Lomon has been running their plants below nameplate capacity. I'm not familiar with the specific utilization numbers."); Turgeon, Tr. 2716 (asked about Billions, "[T]hey are running below their nameplate capacity as of today."); PX2072 at 023 (Cristal presentation)).

802. As Mr. Malichky of PPG, **{** [redacted] **}** (Malichky, Tr. 322-23 (*in camera*)).

803. **{** [redacted] **}** (Malichky, Tr. 322 (*in camera*)). **{** [redacted] **}** (Malichky, Tr. 322 (*in camera*)).

804. **{** [redacted] **}** (Christian, Tr. 806). **{** [redacted] **}** (Christian, Tr. 806).

805. **{** [redacted] (RX0338 at 014 (Tronox 5 Year Strategic Plan, Board Presentation) [redacted] **}**) (*in camera*); PX1681 at 003-08 (March 2015 Van Niekerk/Gan email chain) (*in camera*); PX1268 at 001) (Van Niekerk email to Keegel)**({** [redacted] **})** (*in*

camera); PX1062 at 079 (Tronox presentation) (Lomon Billions **{** [redacted] **})** (*in camera*); PX1062 at 077 (Tronox presentation) (**{** [redacted] **}**) (*in camera*)); PX1671 (Casey email) ("They have expressed interest in "cooperating" with us, but probably not until their combination is closed.")).

806. Moreover, even though Lomon Billions has struggled to make its current chloride TiO2 plant fully operational, Lomon Billions' estimate of the amount of time it will likely take to build its new plant is much faster than other much more experienced operators, such as Chemours. (Romano, Tr. 2140; PX1636 at 001 (Arndt email)). The announced construction time for the new production lines included in Lomon Billions' press release was significantly lower than the amount of time it took other producers to build or expand their plants. (RX0195 at 001-02 (Lomon Billions press release) (Lomon Billions stating it would expect commercial production during 2019); Romano, Tr. 2140 (about 4.5 years to build a greenfield TiO2 plant); PX1636 at 001 (Arndt email) (Altamira plant expansion announced in 2011became operational in 2016)).

807. In any event, a statement in a press release is far from an assurance of what is likely to happen. When Tronox acquired Kemira's TiO2 plants in Savannah, it also put out a press release describing aspirations for the two plants at that site. However, Tronox never met its objectives and it closed the two plants. (PX9070 at 001 (PR Newswire article) (announced plan to achieve $40 million per year in cost reductions); PX7001 (Romano, IHT at 108-09) (**{** [redacted] **}**) (*in camera*)).

ii. Imported Chinese Sulfate TiO2 Would Not Offset Likely Anticompetitive Effects in the Relevant Market for Sale of Rutile TiO2 to North American Customers

808. The vast majority of TiO2 manufactured in China is sulfate TiO2. (Malichky, Tr. 320 ("The chloride material out of China is very, very limited. There's not much of it out there."); PX1036 at 006 (Tronox presentation) ({ }) (*in camera*); PX9023 at 041 (TZMI Report) ("Virtually all production and exports are currently using sulfate technology. For 2015, TZMI expects most production volume to occur via sulfate technology"); PX1091 at 011 (Tronox presentation) ({ }) (*in camera*); PX1033 at 002 (Tan email to Engle) (actual chloride TiO2 production in China estimated at "0.1 mio mt per year" as compared to nameplate capacity of "0.24 mio mt")).

809. The record is clear that most North American customers do not switch from chloride TiO2 to sulfate TiO2 in the face of a SSNIP. (*See* CCFF ¶¶ 111-33, above). But even to the extent that some North American customers would consider using sulfate TiO2, Chinese sulfate TiO2 use by North American customers as a response to a North American price increase would be insufficient to offset a price increase in the rutile market. Limited amounts of Chinese sulfate TiO2 meets the quality standards required by those North American customers. (PX3009 at 030 (Venator presentation) (showing that Chinese titanium dioxide is largely limited to "low end" applications); PX1395 at 008 (Tronox investor draft Q&As) (Chinese "exports have largely stayed within Asia-Pacific to serve low-grade sulfate pigment applications—applications that do not compete with our high-grade chloride applications in the region."); PX3000 at 003 (Venator

presentation) ([redacted]) (*in camera*); PX8006 at 002-03 (¶¶ 13-14) (Pschaidt Decl.) (*in camera*); PX8002 at 004-05 (Christian Decl.) ([redacted]) (*in camera*); PX8003 at 003 (¶14) (Young Decl.) ([redacted]) (*in camera*); PX1399 at 006 (Tronox "Fireside Chat" Q&A) ([redacted]) (*in camera*)).

810. [redacted]. (*See* CCFF ¶ 753, above).

811. In addition to North America concerns with the quality and reliability of supply of Chinese sulfate TiO2, for the reasons identified above, prices for Chinese TiO2, including sulfate TiO2, have risen significantly in recent years, further limiting the incentives and ability of Chinese sulfate TiO2 to offset price increases in North America. (*See* CCFF ¶¶ 771-74, above).

812. Chinese TiO2 would not be cheap enough to offset price effects in North America as shown by the European price increases following the plant fire at Venator's Pori, Finland plant. (*See* CCFF ¶¶ 631-35, above).

C. There Are No Rapid Entrants Who Would Provide Sufficient Supply Responses to Deter or Counteract the Likely Anticompetitive Effects from the Merger

813. Under the Horizontal Merger Guidelines, only firms that "would very likely provide rapid supply responses with direct competitive impact in the event of a SSNIP, without incurring significant sunk costs" are considered market participants. (PX9085 at 018-19 (Horizontal Merger Guidelines, §5.1)).

814. The record evidence in this case does not indicate that there are rapid entrants among overseas producers of chloride TiO2. (*See* CCFF ¶¶ 813-22, below)

815. The major producers of chloride TiO2 outside of North America are also major domestic producers such as Tronox, Cristal, Kronos and Venator. (PX1663 at 051 (TZMI TiO2 Product Cost and Profitability Study 2017)). As existing market participants, these firms are not considered "rapid entrants" into the relevant market of North American sales of chloride TiO2. (PX9085 at 018-19 (Horizontal Merger Guidelines, §5.1)).

816. The experience of the major chloride TiO2 producers—[redacted]—is an additional indicator that overseas chloride TiO2, from any producer, should not be considered "readily available" capacity to supply North America. (*See* CCFF ¶¶ 817-20, below).

817. Tronox's Mr. Romano testified that {[redacted]**}** (PX7001 (Romano, IHT at 75) (*in camera*)). Tronox's Ms. Mei also acknowledged that {[redacted]

[redacted] (Mei, Tr. 3179 (*in camera*)).

818. [redacted] (PX7000 (Snider, IHT at 78-80 ([redacted]) (*in camera*)). [redacted] (PX7000 (Snider, IHT at 67) (*in camera*); PX7004 (Gunther, IHT at 60) ([redacted]) (*in camera*)).

819. [redacted] (PX7035 (Christian, Dep. at 77) (discussing [redacted]) (*in camera*); PX7035 (Christian, Dep. at 77-78) ([redacted]) (*in camera*)).

820. Venator, from its chloride TiO2 plant in the U.K., [redacted] annually. (PX8005 at 004 (¶19) (Maiter, Decl.) (partially *in camera*); PX3025 at 011 (Venator presentation) (*in camera*)).

821. Further, the customer-specific qualification process, which can take years, precludes most firms from being rapid entrants. (*See* CCFF ¶¶ 93-110; 382-89, above).

822. Dr. Hill therefore assessed market shares based on chloride TiO2 sales to targeted customers in North America, and unlike Dr. Shehadeh, did not include speculative sales that were unlikely to affect the market. (*See* CCFF ¶¶ 745-812, above).

VII. EFFICIENCIES

A. Respondents Failed to Substantiate Cognizable Efficiencies Under the Guidelines

i. Dr. Zmijewski Is the Only Expert to Provide a Methodology for Evaluating the Claimed Efficiencies and the Only Expert to Opine About the Claimed Efficiencies in a Guidelines Framework

823. On August 15, 2017, Tronox submitted advocacy to the FTC titled "White Paper on Synergies on Behalf of Tronox" (herein "Synergies White Paper"). The Synergies White Paper purports to describe the efficiencies that Respondents believe will result from the proposed acquisition. (PX0005 at 001-05 (Synergies White Paper) (*in camera*)).

824. Complaint Counsel has relied on Respondents' representations for the understanding that the Synergies White Paper sets forth their efficiencies claims in this matter. **{** [redacted] **}** (PX0003 at 049 (Tronox Narrative Response to 2nd Request Spec. 21) (*in camera*)). **{** [redacted] **}** (PX0002 at 087 (Cristal Narrative Response to 2nd Request Spec. 21) (*in camera*)).

825. **{** [redacted] **}** (PX1475 at 014 (Tronox's Response to Interrogatory 14) (*in camera*)).

826. **{** [redacted] **}** (PX0005 at 002-03 (Synergies White Paper) (*in camera*)).

827. Tronox developed its initial synergies estimates internally and in collaboration with Cristal's management. In addition, it engaged third-party consultant KPMG to review and comment on its synergies. **{** [redacted] **}** (PX0006 at 003 (KPMG Report) (*in camera*)). **{** [redacted] **}** (PX0006 at 003 (KPMG Report) (*in camera*)). **{** [redacted] **}** (PX0006 at 003, 005-06 (KPMG Report) (*in camera*)).

828. {[redacted]} (Zmijewski, Tr. 1436-37, 1440-41 (*in camera*)).

829. Dr. Mark Zmijewski submitted an initial report in this matter on April 6, 2018. (PX5001 at 01 (Zmijewski Initial Report) (*in camera*)). In addition, he submitted two rebuttal reports, the first dated April 30, 2018, rebutting the reports of Respondents' experts Mr. Kenneth Stern and Mr. Basil Imburgia (herein "Zmijewski Rebuttal Report to Stern and Imburgia"); the second dated May 10, 2018, rebutting the report of Respondents' expert Dr. Ramsay Shehadeh (herein "Zmijewski Rebuttal Report to Dr. Shehadeh"). (PX5003 at 01 (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 01 (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)).

830. Dr. Zmijewski evaluated Respondents' claimed efficiencies according to the analytical framework set forth in the Horizontal Merger Guidelines and the Commentary on the Horizontal Merger Guidelines. (Zmijewski, Tr. 1430). His initial report clearly sets forth the applicable standards under the Horizontal Merger Guidelines and his methodology for evaluating the verifiability and merger specificity of claimed efficiencies, which is consistent with those standards. (PX5001 at 012-17 (¶¶ 16-24) (Zmijewski Initial Report) (*in camera*); *see also* Zmijewski, Tr. 1431-33).

831. {[redacted]}

[redacted] (PX5001 at 011-12 (¶ 15) (Zmijewski Initial Report) (*in camera*)). His two rebuttal reports reaffirm this opinion. (PX5003 at 007-08 (¶ 8) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 007 (¶ 6) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)). [redacted] (Zmijewski, Tr. 1442-43 (*in camera*)).

832. [redacted] (PX5001 at 011-12 (¶ 15) (Zmijewski Initial Report) (*in camera*)). His two rebuttal reports reaffirm this opinion. (PX5003 at 007 (¶ 8) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 007 (¶ 6) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)). [redacted] (Zmijewski, Tr. 1442-43 (*in camera*)).

(a) Tronox's experts do not conduct a guidelines analysis of the claimed efficiencies

833. [redacted]

[redacted] (PX5003 at 008 (¶ 10) (Zmijewski Rebuttal Report to Stern and Imburgia (*in camera*); *see also* (Zmijewski, Tr. 1479-80 (*in camera*)).

834. [redacted] (PX7059 (Stern, Dep. at 134-35) (*in camera*)).

835. [redacted] (PX7059 (Stern, Dep. at 40) (*in camera*)).

836. [redacted] (PX7059 (Stern, Dep. at 134-35) (*in camera*)).

837. [redacted]

(PX5003 at 015 (¶ 22) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); *see also* (Zmijewski, Tr. 1479-80 (*in camera*)).

838. {[redacted]} (PX5003 at 040-41, 052 (Appx. B § 9, Appx. C § 6) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*)).

839. {[redacted]} (PX7060 (Imburgia, Dep. at 009-10) (*in camera*); RX1258 at 004 (¶ 8) (Imburgia Report) (*in camera*)).

840. {[redacted]} (PX5005 at 006 (¶ 5) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*); *see also* (Zmijewski, Tr. 1480-81 (*in camera*)).

841. {[redacted]} (Zmijewski, Tr. 1439 (*in camera*)). Further, {[redacted]} (PX7045 (Nolan, Dep. at 47-48) (*in camera*)).

ii. Tronox's Claimed Efficiency of Increased Production at Cristal's Pigment Plant in Yanbu, Saudi Arabia, Is Not Cognizable

842. Respondents claim a synergy related to improving the performance of Yanbu, Cristal's chloride TiO2 plant in Saudi Arabia (herein "Yanbu improvement synergy").

{ [redacted] } (PX0005 at 018-19 (Synergies White Paper) (*in camera*)).

843. { [redacted] } (PX1425 at 001-02 (Yanbu Improvement Plan) (*in camera*)). { [redacted] } (PX1425 at 001-02 (Yanbu Improvement Plan) (*in camera*)). { [redacted] } (PX7023 (Dean, Dep. at 18) (*in camera*)).

844. { [redacted] } (PX1425 at 001 (Yanbu Improvement Plan) (*in camera*)). { [redacted]

[redacted] } (PX1425 at 001 (Yanbu Improvement Plan) (*in camera*)).

{[redacted]

[redacted] } (PX1425 at 001 (Yanbu Improvement Plan) (*in camera*)).

(a) The Yanbu improvement synergy is not verifiable

845. {[redacted] } (PX1425 at 001 (Yanbu Improvement Plan) (*in camera*)).

846. {[redacted] } (PX1425 at 001 (Yanbu Improvement Plan) (*in camera*); *see also* (PX7023 (Dean, Dep. at 18, 22) (*in camera*)). {[redacted] } (PX1425 at 001 (Yanbu Improvement Plan) (*in camera*); *see also* (PX7023 (Dean, Dep. at 18, 22) (*in camera*)).

847. {[redacted] } (PX7023 (Dean, Dep. at 23) (*in camera*)). {[redacted]

[redacted] **}** (PX7023 (Dean, Dep. at 22-23) (*in camera*)).

848. **{**[redacted] **}** (PX7023 (Dean, Dep. at 73-75) (*in camera*)).

849. **{**[redacted] **}** (Zmijewski, Tr. at 1465-66 (*in camera*)). If any underlying calculations exist, Respondents have not presented them.

850. **{**[redacted] **}** (Zmijewski, Tr. 1464-66 (*in camera*); PX5001 at 029 (¶ 39 n.70) (Zmijewski Initial Report) (*in camera*); *see also* PX5003 at 044 (Appx C § 2 n.16) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 010 (¶ 11 n.16) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)).

851. **{**[redacted] **}** (PX1425 at 001 (Yanbu Improvement Plan) (*in camera*)).

{[redacted]

[redacted] (PX7023 (Dean, Dep. at 160-61) (*in camera*)).

852. [redacted] (PX1502 at 001 (Dean email) (*in camera*)). [redacted] (PX7023 (Dean, Dep. at 173-74) (*in camera*)). [redacted] (PX7042 (Gunther, Dep. at 26) (*in camera*)).

853. [redacted] (PX7023 (Dean, Dep. at 43-45) (*in camera*)).

854. Located in Saudi Arabia, Yanbu is different from Hamilton in other ways that can affect productivity. [redacted] (PX7023 (Dean, Dep. at 87-88) (*in camera*)). [redacted] (PX7023 (Dean, Dep. at 87-88) (*in camera*)). [redacted] (PX7023 (Dean, Dep. at 88-89) (*in camera*). [redacted]

[redacted] (PX7023 (Dean, Dep. at 89-90) (*in camera*)).

855. {[redacted]} (PX7012 (Mancini, Dep. at 71) (*in camera*)).

856. {[redacted]} (PX2155 at 001 (Orris email) (*in camera*)). {[redacted]} (PX2487 at 015 (Orris email attaching Yanbu Summit presentation) (*in camera*)).

857. {[redacted]} (PX1425 at 001 (Yanbu Improvement Plan) (*in camera*)). {[redacted]} (PX7012 (Mancini, Dep. at 71-72) (*in camera*)). {[redacted]} (PX7023 (Dean, Dep. at 55-58) (*in camera*)).

858. {[redacted]} (PX0006 at 006 (KPMG Report (*in camera*)). {[redacted]

[redacted] (PX0006 at 006 (KPMG Report (*in camera*)).

859. [redacted] (PX0006 at 005 (KPMG Report) (*in camera*)).

860. [redacted] Zmijewski, Tr. 1463 (*in camera*); PX5001 at 029 (¶ 39) (Zmijewski Initial Report) (*in camera*); PX5003 at 044-46 (Appx C § 2) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 009-11 (¶ 11) (Zmijewski Rebuttal Report to Dr. Shehadeh).

(b) The Yanbu improvement synergy is not merger-specific

861. [redacted] (PX7023 (Dean, Dep. at 99-100) (*in camera*)).

862. Over the last several years, [redacted] (Hewson, Tr. 1612-14 ([redacted]) (*in camera*)). [redacted] (Hewson, Tr. 1619 ([redacted]) (*in camera*)). In fact, [redacted]

[redacted] (Hewson, Tr. 1620 (*in camera*)).

863. [redacted] (Hewson, Tr. 1621 (*in camera*)). Specifically, [redacted] (PX0002 at 020 (Cristal Second Request Response) (*in camera*)). During that period, [redacted] (Hewson, Tr. 1621 (*in camera*)).

864. [redacted] (Hewson, Tr. 1623-24 (*in camera*)).

865. Immediately prior to the Acquisition, [redacted] (Hewson, Tr. at 1626-28 ([redacted]) (*in camera*)). During 2017, [redacted] (Hewson, Tr. 1626-27 (*in camera*); *see* CCFF ¶ 862 ([redacted])). [redacted] (PX2493 at 005 (Morten email attaching Cristal manufacturing update) (*in camera*); PX7048 (Strayer, Dep. at 100) (*in camera*)). [redacted] (PX2471 at 004 (Gunther email attaching Cristal manufacturing update) (*in camera*)).

{ } (PX7042 (Gunther, Dep. at 124-26) (*in camera*); PX7048 (Strayer, Dep. at 218) (*in camera*); *see also* PX2374 at 001 (Gunther email) ({ }). (PX7042 (Gunther, Dep. at 125) (*in camera*)).

866. During 2017, { } (Hewson, Tr. 1635, 1627 (*in camera*)). { } (Hewson, Tr. 1635 (*in camera*)).

867. { } (PX7017 (Hewson, Dep. at 160-61) (*in camera*)).

868. Also during Mr. Hewson's time as VP of Manufacturing, { } (PX7017 (Hewson, Dep. at 159-60) (*in camera*)). { } (PX1425 at 001 (Yanbu Improvement Plan) (*in camera*)).

869. {[redacted]} (PX7048 (Strayer, Dep. at 186) (*in camera*)).

870. {[redacted]} (PX7017 (Hewson, Dep. at 196) (*in camera*)). {[redacted]} (PX7017 (Hewson, Dep. at 196) (*in camera*)).

871. {[redacted]} (PX2471 at 007 (Gunther email attaching Cristal manufacturing update) (*in camera*); PX7042 (Gunther, Dep. at 135) (*in camera*)).

872. [redacted] For example, [redacted] {[redacted]} (PX7048 (Strayer, Dep. at 106) (*in camera*); PX7017 (Hewson, Dep. at 39-40) (*in camera*); *see also* PX2379 at 005 (Gunther email attaching Yanbu org changes) (*in camera*)).

873. {[redacted]} (PX7017

(Hewson, Dep. at 51-52) (*in camera*); PX7048 (Strayer, Dep. at 76) (*in camera*); PX2379 at 005 (Gunther email attaching Yanbu org changes) (*in camera*)).

874. {[redacted]} (PX2379 at 005 (Gunther email attaching Yanbu org changes) (*in camera*)).

875. {[redacted]} (PX7048 (Strayer, Dep. at 117-18) (*in camera*); *see also* PX7042 (Gunther, Dep. at 125-26 (*in camera*)).

876. {[redacted]} (PX1501 at 001 (Dean email) (*in camera*); *see also* PX7023 (Dean, Dep. at 128-30) (*in camera*)).

877. [redacted]} (PX7042 (Gunther, Dep. at 134-35) (*in camera*); *see also* Dean, Tr. 3107-108 (*in camera*); PX2471 at 007 (Gunther email attaching Cristal manufacturing update) (*in camera*)).

878. {[redacted]} (PX7042 (Gunther, Dep. at 125-26) (*in camera*)).

879. {[redacted]} (PX2373 at 018 (Box email attaching 2018 Budget and Strategic Plan) (*in camera*); PX7042 (Gunther, Dep. at 035-36) (*in camera*)). {[redacted]} (PX2373 at 006 (Box email attaching 2018 Budget and Strategic Plan) (*in camera*); PX7042 (Gunther, Dep. at 023-24) (*in camera*)).

880. {[redacted]} (PX7042 (Gunther, Dep. at 030) (*in camera*); PX7048 (Strayer, Dep. at 218) (*in camera*)).

881. {[redacted]} (PX2467 at 001 (Gunther email) (*in camera*); PX7042 (Gunther, Dep. at 149-53) (*in camera*)).

882. {[redacted]} (PX7042 (Gunther, Dep. at 31) (*in camera*)). {[redacted]}

[redacted] (PX7017 (Hewson, Dep. at 182) (*in camera*)).

883. The Tronox Way, which Tronox plans to implement at Yanbu in order to improve performance, contains a number of aspects that Respondents have not shown are merger-specific. [redacted] (Dean, Tr. 3102 (*in camera*)). [redacted] (Dean, Tr. 3102-06 (*in camera*)). [redacted] (Dean, Tr. 3103 (*in camera*)).

884. [redacted] (PX7048 (Strayer, Dep. at 219-220) (*in camera*)). [redacted] (PX2471 at 007 (Gunther email attaching Cristal manufacturing update) ([redacted]) (*in camera*); PX2390 at 005 (Nackshabandi email attaching board minutes) (same) (*in camera*); PX2493 at 005 (Morten email attaching manufacturing update) ([redacted]) (*in camera*); *see also* PX7042 (Gunther, Dep. at 133) (*in camera*)).

885. [redacted] (PX7012 (Mancini, Dep. at

080-81) (*in camera*)). Tronox has not demonstrated why Cristal could not take similar steps to help improve the organizational culture at Yanbu.

886. {[redacted]} (PX1502 (Dean email) (*in camera*); PX7023 (Dean, Dep. at 130-36) (*in camera*)).

887. {[redacted]} Zmijewski, Tr. 1472-76 (*in camera*); PX5001 at 031-32 (¶ 43) (Zmijewski Initial Report) (*in camera*); PX5003 at 046-47 (Appx C § 2) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 028-30 (¶ 32) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)).

iii. Tronox's Claimed Efficiency of Activating the Jazan Slagger in Saudi Arabia Is Not Cognizable

888. Respondents claim a synergy related to activating the Jazan slagger (herein "activating Jazan"). {[redacted]}

[redacted]**}**

(PX0005 at 030-31 (Synergies White Paper) (*in camera*)).

889. The Jazan Slagger is a large smelter facility with furnaces that processes raw material or ilmenite to produce slag and metal. (Van Niekerk, Tr. 3946).

890. **{**[redacted]**}** (PX7008 (Hewson, IHT at 74) (*in camera*)). Tasnee owns Cristal. (Van Niekerk, Tr. 3899).

891. Activating Jazan is not an efficiency generated by the proposed acquisition, as the Jazan slagger is not among the assets to be acquired in that transaction. **{**[redacted]**}** (PX0005 at 027 (Synergies White Paper) (*in camera*)); Van Niekerk, Tr. 3901; *see also* PX0009 (Transaction Agreement)).

892. **{**[redacted]**}**

(PX0010 at 218 (Tronox Board presentation) (*in camera*); PX7012 (Mancini, Dep. at 150) (*in camera*); PX7014 (Quinn, Dep. at 136 (*in camera*)).

893. Instead of including Jazan in the proposed acquisition, Respondents entered into an option agreement on May 10, 2018. Under the terms of the option agreement, Tronox agrees to purchase Jazan if the slagger achieves certain performance metrics within a specified timeframe. (Van Niekerk, Tr. 3970). **{**[redacted]

[redacted]} (RX1603 at 0010-12, 58 (Option Agreement); Van Niekerk, Tr. 3970; PX7009 (Stoll, Dep. at 26-27) (*in camera*); PX7018 (Trabzuni, Dep. at 78-81) (*in camera*); PX7036 (Keegel, Dep. at 57-58) (*in camera*)). {[redacted]} (PX7018 (Trabzuni, Dep. at 80-81) (*in camera*)). Unless all these conditions are met within the next five years, Tronox is not obligated to acquire Jazan. (RX1603 at 0011-012 (Option Agreement); Van Niekerk, Tr. 3901). Thus, even if Tronox acquires Cristal, it does not necessarily acquire Jazan.

894. {[redacted]} (PX1745 (Technical Services Agreement) (*in camera*); PX7038 (Van Niekerk, Dep. at 62-63) (*in camera*)).

895. When referring to the Jazan smelter facility, the term slagger and smelter refer to the same thing. (Van Niekerk, Tr. 3899).

896. {[redacted]} (PX1745 at 021-25 (Technical Services Agreement) (*in camera*); PX7038 (Van Niekerk, Dep. Tr. at 62-65) (*in camera*); Van Niekerk, Tr. 3955).

897. {[redacted]} (PX1745 at 009 (Technical Services Agreement) (*in camera*));

PX7018 (Trabzuni, Dep. at 78) (*in camera*); PX7038 (Van Niekerk, Dep. at 123) (*in camera*)).

(a) The activating Jazan synergy is speculative and not verifiable

(1) The option agreement highlights the speculative nature of the activating Jazan synergy

898. {[redacted]} (PX7014 (Quinn, Dep. at 075-76) (*in camera*); (PX7008 (Hewson, IHT at 75)). {[redacted]} (PX7038 (Van Niekerk, Dep. at 74-75) (*in camera*)). Furthermore, Tronox pursued an option agreement for Jazan, because its valuation of the facility was significantly less than Cristal's valuation. (Quinn, Tr. 2381).

899. Tronox has hedged against the risk that it will not be successful in activating Jazan by securing the reimbursement of its capital contributions to the project in the event the option is not exercised. {[redacted]} (RX1603 at 0027-033, Section 5.14 (Option Agreement) (*in camera*); PX7009 (Stoll, Dep. at 025-26) (*in camera*); Van Niekerk, Tr. 4002; Quinn, Tr. 2374-75).

900. Tronox's CEO, Jeffry Quinn, admitted that he was uncertain if Tronox would acquire the Jazan facility. In response to a question on whether he knew if Tronox would ultimately be able to acquire Jazan, he responded: "No. I think there's – there's no certainty that that will actually occur." (Quinn, Tr. 2375.)

901. Therefore, despite its confident pronouncements, it is clear from Tronox's own behavior that fixing the Jazan facility is a highly uncertain proposition. (PX1281 at 010 (Tronox August 2017 Update) ({ }) (*in camera*)).

902. { } (Zmijewski, Tr. 1459-60 (*in camera*); PX5001 at 027-28 (¶ 38) (Zmijewski Initial Report) (*in camera*); PX5003 at 050-51 (Appx B §5) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 015-16 (¶ 15) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*).

(2) Other factors make the activating Jazan synergy speculative

903. Even with additional expertise and capital, it is uncertain whether the Jazan slagger can be made operational due to design flaws. { } (PX2295 at 064 (AMIC workshop) (*in camera*)). { }

[redacted] } (PX0005 at 026-27 (Synergies White Paper) (*in camera*)).

904. As Respondents' employees have noted, [redacted] { [redacted] } (PX7038 (Van Niekerk, Dep. at 221-22) (*in camera*); *see also* PX1280 at 003 (Van Niekerk email attaching integration slides) ({ [redacted] }) (*in camera*)). { [redacted] } (PX7018 (Trabzuni, Dep. at 80 (*in camera*)).

905. In addition, it is uncertain whether Tronox is particularly well-suited to provide the technical expertise necessary to activate Jazan, [redacted] { [redacted] } (PX2177 at 026 (Fixing Jizan Ilmenite Smelter, Dec. 2016) (*in camera*)); *see also* Van Niekerk, Tr. 3950 (testifying to the big difference between the two AC furnaces at the Jazan Slagger and the DC furnaces in South Africa owned by Tronox); *see also* PX1284 at 038 (Tronox Jazan

site visit report) ({ [redacted] } (*in camera*)).

906. { [redacted] } (PX7036 (Keegel, Dep. at 60-62) (*in camera*).

907. { [redacted] } (PX7012 (Mancini, Dep. at 120-123) (*in camera*); PX7008 (Hewson, IHT. at 87-88) (*in camera*)).

908. { [redacted] } (PX0006 at 005 (KPMG Report) (*in camera*)).

(b) The activating Jazan synergy is not merger-specific

909. Before Respondents entered the proposed acquisition, AMIC was actively exploring options for fixing the Jazan slagger, both in-house and in collaboration with third parties. { [redacted]

[redacted] **}** (PX2196 at 013 (Cristal Titanium Slagger Project, September 2016) (*in camera*); PX7018 (Trabzuni, Dep. at 059) (*in camera*); PX7005 (Keegel, Dep. at 71) (*in camera*)).

910. **{**[redacted]**}** (PX7009 (Stoll, Dep. at 033) (*in camera*)). [redacted] **}** (PX7006 (Stoll, IHT. at 243) (*in camera*)).

911. **{**[redacted]**}** (PX7008 (Hewson, IHT at 059) (*in camera*)). **{**[redacted]**}** (PX7008 (Hewson, IHT at 059-60) (*in camera*); (PX2166 at 002) (*in camera*)).

912. Cristal has taken a number of steps toward restoring operations at the Jazan Slagger smelter facility independent of Tronox acquiring Cristal. **{**[redacted]

[redacted]**}**

(PX2205 at 008 (Board Directives, Dec. 2016) (*in camera*)). **{**[redacted]

[redacted]

[redacted]

[redacted]**}** (PX2205 at 008 (Board Directives, Dec. 2016) (*in camera*)).

913. [redacted]

[redacted]

[redacted]

[redacted]**}** (PX2202 at 001 (Letter from TiZir CEO to Tasnee, August 1, 2016) (*in camera*)).

914. **{**[redacted]

[redacted]

[redacted]

[redacted]

[redacted]**}** (PX2202 at 001 (Letter from TiZir CEO to Tasnee, August 1, 2016) (*in camera*)).

915. **{**[redacted]

[redacted]

[redacted]

[redacted]**}** (PX1079 at 001-03 (Casey/Van Niekerk email) ([redacted]) (*in camera*); (Stoll, Tr. 2103) (*in camera*); PX7008 (Hewson, IHT at 80-81) (*in camera*)). In fact, **{**[redacted]

[redacted]

[redacted] (PX1286 at 012 (Tronox presentation) (*in camera*)).

916. [redacted] (PX2204 at 3-5 (Cristal Titanium Slagger Update & Expectations from AMIC-TiZir Collaboration, October 2016) ([redacted]) (*in camera*)). Dr. Trabzuni reported that that the meeting went well, and described the next steps. (PX2203 (Dr. Fadi Trabzuni/Mutlaq H. Al-Morished email) ("TiZir to conduct a due diligence to verify and confirm their thoughts on design modification requirement for Jazan stagger furnaces.")).

917. [redacted] (PX1079 at 001-03 (Van Niekerk/Casey email) (*in camera*)).

918. [redacted] (PX2164 at 005-34 (Mefos Design Review, Dec. 2016) (*in camera*); (PX2197 (Hatch Statement of Work Proposal, Mar. 30, 2017) (*in camera*)). [redacted]

[redacted] (PX7009 (Stoll, Dep. at 066-68) (*in camera*)).

919. {[redacted]}

(PX7008 (Hewson, IHT at 97) (*in camera*)).

920. {[redacted]}

(PX2199 at 006 (John Ferreira Site Visit Report, Nov. 8, 2016)).

921. {[redacted]}

(PX2177 at 002 (Trabzuni/Herrmann and Wagner, et al., email, December 19, 2016) (discussing AMIC projects) (*in camera*)).

922. {[redacted]} (PX2206 at 023 (Introduction to AMIC, January 2017) (*in camera*)). {[redacted]} (PX7018 (Trabzuni, Dep. at 046) (*in camera*)).

923. {[redacted]} (PX2236 (Livingston/Trabzuni et al. email chain) (*in camera*)).

924. {[redacted]} (PX2295 at 005 (AMIC Workshop, February 2017) (*in camera*)).

925. {[redacted]} (PX2295 at 037-54 (AMIC Workshop, February 2017) (*in camera*)). {[redacted]} (PX2295 at 056 (AMIC Workshop, February 2017) (*in camera*); *see also* PX2177 at 040 (Tasnee Strategy and Growth, fixing the Jazan ilmenite smelter) ({[redacted]}) (*in camera*)). {[redacted]} (PX7018 (Trabzuni, Dep. at 145-47) (*in camera*)).

926. {[redacted]} (PX2295 at 68 (AMIC Workshop, February 2017) (Modifications Already Carried Out/Planned.") (*in camera*)). {[redacted]}

927. {[redacted]} (PX2295 at 67 (AMIC Workshop, February 2017) (*in camera*)). {[redacted]} (PX2295 at 38, 56 (AMIC Workshop, February 2017) (*in camera*)). {[redacted]} (PX7018 (Trabzuni, Dep. at 117) (*in camera*)).

928. Even after Tronox announced the proposed acquisition on February 21, 2017, efforts address the problems at Jazan continued. In June 2017, a Tasnee press release affirmed that "work is still ongoing to solve the technical problems" at the Jazan slagger, projecting trial operation during the first half of 2018. (PX9029 (Tasnee Press Release on Jazan Slagger); PX7008 (Hewson, IHT. at 101) (*in camera*); PX7005 (Keegel, Dep. at 71) (*in camera*)).

929. While Tronox's Mr. Van Niekerk stated during the Commission's investigation that {[redacted]}

[redacted] Tronox took the exact opposite position [redacted] (PX7007 (Van Niekerk, IHT, at 213) (*in camera*); PX1373 at 004 ([redacted]) (*in camera*)).

930. There is no evidence that, prior to the Proposed Acquisition, Cristal had abandoned its efforts to make the Jazan slagger operational. (PX7018 (Trabzuni Dep. at 117 ([redacted]) (*in camera*)).

931. Even in March 2017, in its Annual Report to shareholders, Tasnee affirmed its intention to make the Jazan Slagger operational: "The company aims to complete a series of projects under construction and planned to enter the trial production phase during the second half of 2017, including the titanium Smelter Project to produce raw material (slag) to produce titanium dioxide . . . ." (PX9090 at 20 (Tasnee Annual Report, March, 2017)).

932. [redacted]

[redacted]**}** (Zmijewski, Tr. 1471-72 (*in camera*); PX5001 at 030-31 (¶ 42) (Zmijewski Initial Report) (*in camera*); PX5003 at 051-52 (Appx B § 5) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 034-35 (¶ 38) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)).

iv. Tronox's Other Claimed Output Efficiencies Are Not Cognizable

(a) Respondents' claimed synergy of applying best practices across TiO2 pigment plants is not cognizable

933. **{**[redacted]**}** (PX0005 at 019 (Synergies White Paper) (*in camera*)). **{**[redacted]**}** (PX0005 at 019-20 (Synergies White Paper) (*in camera*)). **{**[redacted]**}** (PX1646_Native at Tab 54 (Tronox Synergy Spreadsheet) (*in camera*)).

934. **{**[redacted]**}** (PX1216 at 002 (Mancini email chain) (*in camera*)).

{ } (PX1216 at 002 (Mancini email) (*in camera*)).

935. { } (PX2214 at 002 (Orris email) (*in camera*)).

936. { } (PX0006 at 071 (KPMG Report) (*in camera*)).

937. { } (PX7032 (Orris, Dep. at 36-45) (*in camera*)). { } (Zmijewski, Tr. 1465 (*in camera*)). { } (Zmijewski, Tr. 1464 (*in camera*)). As Dr. Zmijewski explained, { } (Zmijewski, Tr. 1464-65 (*in camera*)). { } (Zmijewski, Tr. 1466-67 (*in camera*)).

938. { } (PX5001 at 029 (¶ 39)

(Zmijewski Initial Report) (*in camera*)). Accordingly, he opines that the TiO2 best practices synergy is not verifiable. (PX5001 at 029 (¶ 39) (Zmijewski Initial Report); PX5003 at 031 (Appx C § 1) (Zmijewski Rebuttal Report to Stern and Imburgia); PX5005 at 012-14 (¶ 13) (Zmijewski Rebuttal Report to Dr. Shehadeh)). Therefore the synergy is not cognizable. (Zmijewski, Tr. 1430-31 (describing criteria for cognizable efficiencies under Horizontal Merger Guidelines)).

939. As Dr. Zmijewski notes, Tronox declined to provide detail on any specific intellectual property rights related to the relevant TiO2 best practices. (PX5003 at 043-44 (Appx C § 1) (Zmijewski Rebuttal Report to Stern and Imburgia); PX5005 at 031-32 (¶ 36) (Zmijewski Rebuttal Report to Dr. Shehadeh)).

940. Accordingly, Dr. Zmijewski found that Respondents have not demonstrated the extent to which the TiO2 best practices synergy is merger-specific. (PX5003 at 031 (Appx C § 1) (Zmijewski Rebuttal Report to Stern and Imburgia); PX5005 at 031-32 (¶ 36) (Zmijewski Rebuttal Report to Dr. Shehadeh)).

(b) Respondents have not provided sufficient information to evaluate their claimed synergy of activating capacity, idled because of Tronox's current "net long" position

941. {[redacted]} (PX0005 at 022 (Synergies White Paper) (*in camera*)). According to Tronox, {[redacted]} (PX0005 at 023 (Synergies White Paper) (*in camera*)).

942. According to Tronox, **{** [redacted] **}** (PX0005 at 023-24 (Synergies White Paper); PX5001 at 029 (¶ 38 n.68) (Zmijewski Initial Report) (*in camera*)).

943. **{** [redacted] **}** (PX5001 at 029 (¶38 n.68) (Zmijewski Initial Report) (*in camera*)).

944. **{** [redacted] **}** (PX5003 at 034-35 (Appx C § 4) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*)). Accordingly, he opines that Respondents have failed to demonstrate that the activating idled feedstock capacity synergy is merger-specific. (PX5003 at 034-35 (Appx C § 4) (Zmijewski Rebuttal Report to Stern and Imburgia)). Therefore, the synergy is not cognizable. (Zmijewski, Tr. 1430-31 (describing criteria for cognizable efficiencies under Horizontal Merger Guidelines)).

(c) Respondents' claimed synergy of swapping ilmenite between mines at reactivated slag furnaces is not cognizable

945. {[redacted]} (PX0005 at 022 (Synergies White Paper) (*in camera*)). {[redacted]} (PX0005 at 024-25 (Synergies White Paper) (*in camera*)). {[redacted]} (PX0005 at 024-25 (Synergies White Paper) (*in camera*)).

946. {[redacted]} (PX0006 at 005 (KPMG Report) (*in camera*)). {[redacted]} (PX0006 at 005 (KPMG Report) (*in camera*)).

947. Because it relies on the assumption of the activating Jazan synergy, which is not verifiable, Dr. Zmijewski opines that the ilmenite swap synergy also is not verifiable. (PX5003 at 032-33 (Appx C § 3) (Zmijewski Rebuttal Report to Stern and Imburgia); PX5005 at 017-18 (¶ 17) (Zmijewski Rebuttal Report to Dr. Shehadeh)). Therefore, the ilmenite swap synergy is not cognizable. (Zmijewski, Tr. 1430-31 (describing criteria for cognizable efficiencies under Horizontal Merger Guidelines)).

948. Dr. Zmijewski also notes that Respondents have not presented evidence that the ilmenite swap synergy could not practically be accomplished absent the proposed acquisition. (PX5003 at 032-33 (Appx C § 3) (Zmijewski Rebuttal Report to Stern and Imburgia); PX5005 at 035-36 (¶ 40) (Zmijewski Rebuttal Report to Dr. Shehadeh)).

v. Tronox's Claimed Cost Savings Efficiencies Are Not Cognizable

949. Respondents claim cost saving synergies of **{** **}** following the transaction. (PX0005 at 034 (Synergies White Paper) (*in camera*)).

(a) Respondents' claimed "value in use" synergy is not cognizable

950. Respondents claim a synergy related to "value in use" of **{** **}** (PX0005 at 034 (Synergies White Paper) (*in camera*)). **{**

} (PX0005 at 034 (Synergies White Paper) (*in camera*)).

951. **{**

} (PX0006 at 064 (KPMG Report) (*in camera*); PX7050 (Mei, Dep. at 224) (*in camera*)).

{

} (PX0006 at 064 (KPMG Report) (*in camera*)).

952. **{**

} (PX7036 (Keegel, Dep. at 41-42) (*in camera*)).

953. **{** [redacted] **}** (PX7050 (Mei, Dep. at 90) (*in camera*)).

954. **{** [redacted] **}** (PX1646_Native at Tab 15 (Tronox Synergy Spreadsheet) (*in camera*)); PX0006 at 065 (KPMG Report) (*in camera*)). **{** [redacted] **}** (PX7032 (Orris, Dep. at 31-34) (*in camera*)).

955. **{** [redacted] **}** (PX0006 at 064 (KPMG Report) (*in camera*)).

956. **{** [redacted] **}** (PX5001 at 029-30 (¶ 40) (Zmijewski Initial Report) (*in camera*); PX5003 at 031 (Appx B § 1) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 023-24 (¶ 26) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*); Zmijewski, Tr. 1452-54 (*in camera*)). **{** [redacted] **}** (PX5001 at 029-30 (¶ 40) (Zmijewski Initial Report) (*in camera*); PX5003 at 031 (Appx B §1) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 023-24 (¶ 26) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*); Zmijewski, Tr. 1453-54 (*in*

camera)). Therefore, the synergy is not cognizable. (Zmijewski, Tr. 1430-31 (describing criteria for cognizable efficiencies under Horizontal Merger Guidelines)).

(b) Respondents' claimed "optimize pigment logistics cost" synergy is not cognizable

957. Respondents claim a synergy related to "optimize pigment logistics cost" of **{** **}** (PX0005 at 034 (Synergies White Paper) (*in camera*)). They describe this synergy as **{** **}** (PX0005 at 034 (Synergies White Paper) (*in camera*)).

958. **{** **}** (PX1646_Native at Tab 34 (Tronox Synergy Spreadsheet) (*in camera*)). **{** **}** (PX0006 at 080 (KPMG Report) (*in camera*)).

959. **{** **}** (PX0006 at 080 (KPMG Report) (*in camera*)).

960. **{** **}** (PX5001 at 029-30 (¶ 40) (Zmijewski Initial Report) (*in camera*); PX5003 at 032 (Appx B §2) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 024 (¶ 27) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)). **{** **}** (PX5001 at 029-30 (¶ 40)

(Zmijewski Initial Report) (*in camera*); PX5003 at 032 (Appx B § 2) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 024 (¶ 27) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)). Therefore, the synergy is not cognizable. (Zmijewski, Tr. 1430-31 (describing criteria for cognizable efficiencies under Horizontal Merger Guidelines)).

(c) Respondents' claimed "supply chain, including PET coke savings" synergy is not cognizable

961. Respondents claim a synergy related to "supply chain, including PET coke savings" of {[redacted]} (PX0005 at 034 (Synergies White Paper) (*in camera*)). {[redacted]} (PX0005 at 034 (Synergies White Paper) (*in camera*)). {[redacted]} (PX1646_Native at Tab 40, 43 (Tronox Synergy Spreadsheet) (*in camera*)).

962. {[redacted]} (PX0006 at 037 (KPMG Report) (*in camera*)).

963. {[redacted]} (PX0006 at 039 (KPMG Report) (*in camera*)). {[redacted]} (PX0006 at 039 (KPMG Report) (*in camera*)).

964. {[redacted]} (PX0006 at 039 (KPMG Report) (*in camera*)). {[redacted]} (PX0006 at 037 (KPMG Report) (*in camera*)).

965. {[redacted]} (PX7005 (Keegel, IHT at 203) (*in camera*)).

966. {[redacted]} (RX0542 at 002 (Shelden email) (*in camera*)). {[redacted]} (RX0542 at 002 (Shelden email) (*in camera*)). {[redacted]} (PX0006 at 039 (KPMG Report) (*in camera*)).

967. {[redacted]} (PX5003 at 032-33 (Appx B § 3) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 020-21 (¶ 22) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)). {[redacted]} (PX5003 at 032-33 (Appx B § 3) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 020-21 (¶ 22) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)). Therefore, the

synergy is not cognizable. (Zmijewski, Tr. 1430-31 (describing criteria for cognizable efficiencies under Horizontal Merger Guidelines)).

968. **{** **}** (PX1646_Native at Tab 40 (Tronox Synergy Spreadsheet) (*in camera*); PX0006 at 067-68 (KPMG Report) (*in camera*)). **{** **}** (Zmijewski, Tr. 1450-51 (*in camera*)).

969. **{** **}** (PX0006 at 067 (KPMG Report) (*in camera*)).

970. **}** (PX1216 at 002 (Mancini email to Van Niekerk and Keegel) (*in camera*)).

971. **{** **}** (PX5001 at 029-30 (¶ 40) (Zmijewski Initial Report) (*in camera*); PX5003 at 032-33 (Appx B § 3) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 020-21 (¶ 22) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*); Zmijewski, Tr. 1448-50 (*in camera*)). Therefore, the synergy is

not cognizable. (Zmijewski, Tr. 1430-31 (describing criteria for cognizable efficiencies under Horizontal Merger Guidelines)).

(d) Respondents' claimed "Western Australia chlorine optimization" synergy is not cognizable

972. Respondents claim a synergy related to "Western Australia chlorine optimization" **{** **}** (PX0005 at 034 (Synergies White Paper) (*in camera*)). **{** **}** (PX0005 at 034 (Synergies White Paper) (*in camera*)).

973. **{** **}** (PX1646_Native at Tab 50 (Tronox Synergy Spreadsheet) (*in camera*); PX0006 at 41 (KPMG Report) (*in camera*)). As Dr. Zmijewski notes, Respondents have not presented adequate foundation for these assumptions. (PX5003 at 034-35 (Appx B § 4) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 021-22 (¶ 23) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)). **{** **}** (PX5003 at 034-35 (Appx B § 4) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 021-22 (¶ 23) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)). Therefore, the synergy is not cognizable. (Zmijewski, Tr. 1430-31 (describing criteria for cognizable efficiencies under Horizontal Merger Guidelines)).

974. Dr. Zmijewski also notes that Respondents have not explained why **{** **}** (PX5003 at 034-

35 (Appx B § 4) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 037-38 (¶ 44) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)). **{** **}** (PX5003 at 034-35 (Appx B § 4) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 037-38 (¶ 44) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)).

(e) Respondents' claimed "optimize chlorinator control" synergy is not cognizable

975. Respondents claim a synergy related to "optimize chlorinator control" of **{** **}** (PX0005 at 034 (Synergies White Paper) (*in camera*)). **{** **}** (PX0005 at 034 (Synergies White Paper) (*in camera*)).

976. **{** **}** (PX1646_Native at Tab 53 (Tronox Synergy Spreadsheet) (*in camera*)); PX0006 at 050-51 (KPMG Report) (*in camera*)). As Dr. Zmijewski notes, Respondents have not presented adequate foundation for these assumptions. (PX5003 at 035-36 (Appx B § 5) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 022 (¶ 24) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)). **{** **}** (PX5003 at 035-36 (Appx B § 5) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 022 (¶ 24) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)). Therefore, the

synergy is not cognizable. (Zmijewski, Tr. 1430-31 (describing criteria for cognizable efficiencies under Horizontal Merger Guidelines)).

977. Dr. Zmijewski also notes that Respondents have not presented evidence that {[redacted]} or that the synergy could not be achieved absent the proposed acquisition. (PX5003 at 035-36 (Appx B § 5) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 038-39 (¶ 45) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)). {[redacted]} (PX5003 at 035-36 (Appx B § 5) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 038-39 (¶ 45) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)).

(f) Respondents' claimed "recover rail car heels" synergy is not cognizable

978. Respondents claim a synergy related to "recover rail car heels" of {[redacted]} (PX0005 at 034 (Synergies White Paper) (*in camera*)). {[redacted]} (PX0005 at 034 (Synergies White Paper) (*in camera*)).

979. {[redacted]} (PX1646_Native at Tab 54, 55 (Tronox Synergy Spreadsheet) (*in camera*)). As Dr. Zmijewski notes, Respondents have not presented adequate foundation for these assumptions. (PX5003 at 036-37 (Appx B § 6) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 024-25 (¶ 28)

(Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)). {[redacted]} (PX5003 at 036-37 (Appx B § 6) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 024-25 (¶ 28) (Zmijewski Rebuttal Report to Dr. Shehadeh) (*in camera*)). Therefore, the synergy is not cognizable. (Zmijewski, Tr. 1430-31 (describing criteria for cognizable efficiencies under Horizontal Merger Guidelines)).

980. {[redacted]} (PX7023 (Dean, Dep. at 139-40) (*in camera*); PX1505 at 002 (Gilman email chain) (*in camera*)). {[redacted]} (PX5001 at 032-33 (¶ 44) (Zmijewski Initial Report) (*in camera*); PX5003 at 036-37 (Appx B § 6) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*); PX5005 at 039 (¶¶ 46-47) (Zmijewski Rebuttal Report to Dr. Shehadeh); Zmijewski, Tr. 1470-71 (*in camera*)).

(g) Respondents' claimed "duplicative fixed and corporate costs—3rd party spend" synergy is not cognizable

981. Respondents claim a synergy related to {[redacted]} (PX0005 at 034 (Synergies White Paper) (*in camera*)). {[redacted]} (PX0005 at 034 (Synergies White Paper) (*in camera*)).

982. {[redacted]} (PX0006 at 104-05, 107-09 (KPMG Report) (*in camera*)). {[redacted]} (PX0006 at 104-05, 107-09 (KPMG Report) (*in camera*)).

983. As Dr. Zmijewski notes, Respondents have not presented adequate foundation for {[redacted]} (PX5003 at 038-39 (Appx B § 7) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*)). {[redacted]} (PX5003 at 038-39 (Appx B § 7) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*)). Therefore, the synergy is not cognizable. (Zmijewski, Tr. 1430-31 (describing criteria for cognizable efficiencies under Horizontal Merger Guidelines)).

(h) Respondents' claimed "duplicative fixed and corporate costs—headcount related + corp allocation Tasnee" synergy is not cognizable

984. Respondents claim a synergy related to "duplicative fixed and corporate costs—headcount related + corp allocation Tasnee" of {[redacted]} (PX0005 at 034 (Synergies White Paper) (*in camera*)). {[redacted]} (PX0005 at 034 (Synergies White Paper) (*in camera*)).

985. {[redacted]} (PX0006 at 082 (KPMG Report) (*in camera*)).

986. **{** [redacted] **}** (PX0006 at 082 (KPMG Report) (*in camera*)).

987. Several components of the "headcount related + corp allocation Tasnee" synergy rely on unfounded assumptions. **{** [redacted] **}** (PX0006 at 093 (KPMG Report) (*in camera*)). **{** [redacted] **}** (PX0006 at 092, 086-87 (KPMG Report) (*in camera*)).

988. **{** [redacted] **}** (PX7036 (Keegel, Dep. at 34) (*in camera*); PX7005 (Keegel, IHT at 11-12) (*in camera*)). As the Horizontal Merger Guidelines point out, "[r]esearch and development cost savings may be substantial and yet not be cognizable efficiencies because they are difficult to verify or result from anticompetitive reductions in innovative activities." (PX9085 at 034 (Horizontal Merger Guidelines, § 10)).

989. As Dr. Zmijewski notes, Respondents have not presented adequate foundation for these assumptions. (PX5003 at 039-40 (Appx B at § 8) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*)). **{** [redacted] **}** (PX5003 at 039-40 (Appx B at § 8) (Zmijewski Rebuttal Report to Stern and Imburgia) (*in camera*)). Therefore, the synergy is not cognizable. (Zmijewski, Tr. 1430-31 (describing criteria for cognizable efficiencies under Horizontal Merger Guidelines)).

990. {[redacted]} (PX1216 at 002 (Van Niekerk email chain) (*in camera*)).

991. {[redacted]} (RX0171 at 131 (¶ 282) (Stern Report) (*in camera*)).

992. {[redacted]} (PX7059 (Stern, Dep. at 165-66) (*in camera*)).

993. {[redacted]} (PX7059 (Stern, Dep. at 166) (*in camera*)).

vi. Tronox's Claimed Efficiencies of Vertical Integration Are Not Cognizable

(a) Since becoming vertically integrated with the Exxaro merger, Tronox has on multiple occasions reduced production of both feedstock and TiO2 pigment

994. Rather than relying on cost savings from vertical integration to expand output, Tronox has instead managed its production of feedstock, and consequently TiO2, in order to

affect the pricing of TiO2 in North America. (Hill, Tr. 1891-92). **{** [redacted] **}** (PX5002 at 025 (¶ 50) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*); PX5000 at 121 (¶ 280) [redacted] **}**) (*in camera*); PX1012 at 045 (Tronox presentation) (describing **{** [redacted] **}**) (*in camera*)).

995. Over last several years, Tronox has sought to "hold price," rather than be an aggressive competitor in TiO2 by increasing its output. Instead, Tronox has curtailed its production on multiple occasions. (*See* CCFF ¶¶ 587-612, above). Tronox has used its production decisions at both the feedstock level and for TiO2 to pigment to limit supply and maintain pricing – and those decisions appears to have contributed to reduced competition at each level of the industry. (*See* CCFF ¶¶ 606-10, above).

996. At the feedstock level, for example, Tronox in 2014 concluded that [redacted]

[redacted] (PX1628 at 003 (Turgeon email attaching Memo to Tronox Board) (*in camera*)). [redacted] (PX1112 (Email between Casey and Romano) (*in camera*)).

997. [redacted] (PX1394 at 003 (Van Wyk email attaching memo) (*in camera*)). [redacted] (PX1394 at 006 (Van Wyk email attaching memo) (*in camera*)). Tronox at the beginning of 2015 closed one of the two KZN furnaces. (Turgeon, Tr. 2648).

998. As it has with TiO2 pigment production decisions, Tronox shared in its public disclosures its view of how reducing its feedstock production impacted supply and pricing, and impacted decisions by the other feedstock producers. For example, when asked in the company's 2015 Q1 earnings call about whether Tronox's decision to reduce sales had impacted feedstock pricing, Tom Casey responded that "objectively perhaps it didn't result in a skyrocketing slag price, but we think it resulted in improvement in the market." (PX9007 at 009 (Tronox 2015 Q1 Earnings Call Transcript)). Further, he described the influence he believed that Tronox's decision had on the other feedstock

producers: "We think that the second quarter of 2014 was the low point in high-grade feedstock prices, and in fact that prices in this quarter and in the second half of 2014 were higher than in the second quarter of 2014 on average slag prices around the world. That is in part, we believe again, because we withdrew from the market. I think Rio responded to that by withdrawing from the market, Iluka took synthetic rutile out of the market." (PX9007 at 009 (Tronox 2015 Q1 Earnings Call Transcript)).

999. In 2015, Tronox also reduced production of TiO2 pigment by about 15% at two of its plants, Hamilton and Kwinana. (*See* CCFF ¶¶ 427-29, 611, above). Public statements and internal documents of Tronox again indicate that an objective of that reduced production was to support higher pricing of TiO2 pigment. (*See* CCFF ¶¶ 427, 606-10, above).

1000. Contrary to its claims with respect to the expected benefits of increased vertical integration, Tronox has not capitalized on its existing levels of vertical integration to take market share in TiO2 pigment. Instead, the evidence for feedstock and the evidence for TiO2 pigment, suggests the opposite. Increasing the degree of vertical integration would not result in cost savings being shared with customers; rather, it would give Tronox control over even more production upstream and downstream with which to pursue its strategy of managing production to maintain pricing. (*See* CCFF ¶¶ 452, 454-57, 459, 606-10, , above).

1001. Beginning at the time of the Tronox and Exxaro merger, in fact, key personnel at Tronox have viewed [redacted] for the combined company. {[redacted]

[redacted] (PX1635 (Van Niekerk email chain) (*in camera*)). [redacted] (PX1113 at 001 (Von Horn email) (*in camera*)).

1002. [redacted] (PX1113 at 001 (Von Horn email) (*in camera*); PX1112 (Email between Casey and Romano) ([redacted]) (*in camera*)). [redacted] (PX5002 at 025 (¶ 50) (Hill Rebuttal Report to Stern and Imburgia) (*in camera*).

(b) Through increased production of TiO2 pigment, Tronox has ability to enhance its vertical integration absent the proposed acquisition

1003. Because Tronox is already long on feedstock, it already has the ability and incentive to expand its production of chloride process TiO2. Therefore, because Tronox has options to increase vertical integration other than through the acquisition of Cristal, its claimed synergies of increased vertical integration are not merger specific. (*See* CCFF ¶¶ 1004-10, below).

1004. As reflected in a wide range of ordinary-course business documents, including high-level planning documents, [redacted] (PX1362 at 002 (2012 Board Presentation) (*in camera*)). [redacted] (PX1370 at 047 (Staton email attaching Tronox 2014 5-Year Business Plan) (*in camera*)). [redacted] (PX1380 at 012 (Keegel email attaching presentation) (*in camera*)).

1005. Immediately after Tronox acquired Exxaro (*see* PX1097 at 001-09 (October 2011 Tronox investor presentation)), [redacted] (PX1034 at 001 (Van Niekerk email) (*in camera*)).

1006. When Tronox acquired Exxaro in 2012, Tronox also emphasized the opportunity for organic pigment expansion in public disclosures. For example, an October 2011 Investor Presentation described [redacted]

[redacted]

(PX1097 at 009 (Tronox investor presentation)).

1007. In a 2014 presentation, Tronox **{**[redacted]**}** (PX1377 at 014 (Presentation to Anixter International) (*in camera*)). **{**[redacted]**}** (PX1377 at 014 (Presentation to Anixter International) (*in camera*)).

1008. Tronox earnings calls from the period after the acquisition emphasized how Tronox viewed its vertical integration as a foundation for organic expansion of TiO2 pigment production. Specifically, in 2012 Mr. Casey stated that "[being long on feedstock] also provides us the opportunity if we were ever to expand either through acquisitions or brownfield expansions, we can feed the expansion with our own feedstock and even increase the advantage that we have so it gives us a lot of flexibility. We like that." (PX9033 at 014 (Tronox Q2 2012 Earnings Call)). A year later he stated that "the way we think about it is that if we invest in, for example, Hamilton, our plant in Mississippi or in Botlick [sic] or even in Kwinana, the plant in Australia, we could add lines incrementally. And so our choice would be do we add one line, do we add two lines, do we do a substantial increase? . . . Do we think that the — that an acquisition that is available to us is impactful sufficiently far in advance of the financial impact of incremental expansion that it's worth doing, and particularly that will be a function of how we see demand going in the market over the year or two that we would be building

any organic. As I said earlier, my inclination is to go to — at least at the short term to look at the inorganic rather than the organic, but we are looking at both." (PX9014 at 008 (Tronox Q2 2013 Earnings Call)).

1009. Absent the acquisition, Tronox would continue to have opportunities to expand its own TiO2 production to take advantage of its long position in high-grade feedstock, particularly since Tronox and other market participants recognize the tight supply of TiO2 pigment. (Arndt, Tr. 1422; Pschaidt, Tr. 973-74). **{** [redacted] **}** (PX1012 at 045-46 (Tronox TiO2 2017 strategic plan) (*in camera*)). **{** [redacted] **}** (PX7001 (Romano, IHT at 31) (*in camera*)).

1010. **{** [redacted] **}** (PX1036 at 019 (Keegel Email attaching 5-year Plan) (*in camera*)).

B. Tronox Has Not Demonstrated that the Claimed Efficiencies at Facilities Located Outside North America Would Positively Impact North American Customers

1011. Tronox's CEO, Mr. Quinn, testified that "[t]he synergies that are tied to a geographic location are the operational synergies . . . and I would agree with you that the

overwhelming majority of those synergies are related to ex – you know, non-U.S. assets." (Quinn, Tr. 2407).

1012. Tronox acknowledges that it has not attempted to quantify the extent to which its claimed efficiencies would benefit North American customers of chloride TiO2. **{** [redacted] **}** (PX7014 (Quinn, Dep. at 104-05) (*in camera*)).

1013. **{** [redacted] **}** (PX7000 (Snider, IHT at 69-70) (*in camera*)). Consistent with this, Mr. Hewson of Cristal testified that Yanbu's TiO2 customers are **{** [redacted] **}** (Hewson, Tr. 1608 (*in camera*)).

1014. Even if Jazan becomes operational, Tronox has not demonstrated that this claimed synergy, which concerns the production of titanium feedstock—not chloride TiO2—in Saudi Arabia, would benefit North American chloride TiO2 customers. (*See* CCFF ¶¶ 1011-12, above).

1015. **{** [redacted] **}** (PX5001 at 055 (Exhibit V-1) (Zmijewski Initial Report) (*in camera*); *see* CCFF Section III.A.ii., above). **{** [redacted] **}** (PX7005 (Keegel, IHT at

155-56) (*in camera*)). **{** [redacted] **}** (PX7005 (Keegel, IHT at 155-56) (*in camera*)).

1016. **{** [redacted] **}** (PX5001 at 055 (Exhibit V-1) (Zmijewski Initial Report) (*in camera*); *see* CCFF Section III.A.ii., above).

1017. **{** [redacted] **}** (PX0006 at 040 (KPMG Report) (*in camera*); *see* CCFF Section III.A.ii., above).

COMPLAINT COUNSEL'S PROPOSED CONCLUSIONS OF LAW

A. THE FEDERAL TRADE COMMISSION HAS JURISDICTION OVER THIS ACTION

1. The Federal Trade Commission has jurisdiction over Respondents Tronox Limited, National Industrialization Company, National Titanium Dioxide Company, and the subject matter of this proceeding pursuant to Section 5 of the Federal Trade Commission Act ("FTC Act"), 15 U.S.C. § 45, and Sections 7 and 11 of the Clayton Act, 15 U.S.C. § 18, 21(b).

2. The FTC is an administrative agency of the U.S. Government established, organized, and existing pursuant to the FTC Act, 15 U.S.C. § 41 *et seq*. (2006). The FTC is vested with authority and responsibility for enforcing, *inter alia*, Section 7 of the Clayton Act, 15 U.S.C. § 18, and Section 5 of the FTC Act, 15 U.S.C. § 18.

3. Respondents, including their relevant operating subsidiaries, are, and at all relevant times have been, engaged in activities in or affecting "commerce" as defined in Section 4 of the FTC Act, 15 U.S.C. § 44 (2006), and Section 1 of the Clayton Act, 15 U.S.C. § 12 (2006). (Joint Stipulations of Law and Fact, JX0001-001).

B. THE MERGER IS A VIOLATION OF CLAYTON ACT SECTION 7 AND FTC ACT SECTION 5

4. Pursuant to a February 21, 2017 agreement, Tronox seeks to acquire Cristal's TiO2 business for $1.67 billion in cash and a 24% stake in the combined entity. The acquisition of Cristal is a transaction subject to Section 7 of the Clayton Act and Section 5 of the FTC Act. 15 U.S.C. § 21(a) and §45(a)(2).

5. Complaint Counsel's antitrust claims are brought under Section 7 of the Clayton Act and Section 5 of the FTC Act. Section 7 of the Clayton Act prohibits mergers "the effect of

[which] may be substantially to lessen competition" in "any line of commerce." 15 U.S.C. § 18. Section 5 of the FTC Act proscribes "[u]nfair methods of competition in or affecting commerce…." 15 U.S.C. § 45(a)(1). An acquisition that violates the Clayton Act also violates Section 5 of the FTC Act. *See FTC v. Ind. Fed'n of Dentists*, 476 U.S. 447, 454 (1986).

6. Section 7 of the Clayton Act is intended to prevent anticompetitive mergers "in their incipiency," *before* they create anticompetitive harm. *See United States v. Phila. Nat'l Bank*, 374 U.S. 321, 362 (1963) (internal quotation marks omitted).

7. For the government to prevail in a Section 7 case, "certainty, even a high probability, need not be shown," and any "doubts are to be resolved *against* the transaction." *FTC v. Elders Grain, Inc.*, 868 F.2d 901, 906 (7th Cir. 1989) (emphasis added) (citing *Phila. Nat'l Bank*, 374 U.S. at 362–63); *see also Brown Shoe Co. v. United States*, 370 U.S. 294, 323 (1962). "Congress used the words '*may* be substantially to lessen competition' . . . to indicate that its concern was with probabilities, not certainties." *FTC v. H.J. Heinz Co.*, 246 F.3d 708, 713 (D.D.C. 2001).

8. Courts typically assess whether a merger violates Section 7 by determining: (1) the "line of commerce," or relevant product market; (2) the "section of the country," or relevant geographic market; and (3) the merger's probable effect on competition in the relevant product and geographic markets. *See, e.g., United States v. Marine Bancorp. Inc.*, 418 U.S. 602, 618-24 (1974); *Chi. Bridge & Iron Co. v. FTC*, 534 F.3d 410, 422-23 (5th Cir. 2008).

9. By showing that the proposed "transaction will lead to undue concentration in the market," the Commission "establish[es] a presumption of anticompetitive effect." *United*

States v. Anthem, Inc., 855 F.3d 345, 349 (D.C. Cir. 2017) (internal quotation marks omitted) (citing *United States v. Baker Hughes Inc.*, 908 F.2d 981, 982 (D.C. Cir. 1990)). This presumption establishes a *prima facie* case that the merger is unlawful. *See id*.

10. Once the presumption is established, Respondents bear the burden of rebutting the *prima facie* case. *See Marine Bancorp,* 418 U.S. at 631. "The more compelling the prima facie case, the more evidence the defendant must present to rebut it successfully." *Anthem*, 855. F.3d at 345–50 (internal quotation marks omitted).

11. If Respondents present evidence sufficient to rebut the presumption, then the burden of producing additional evidence of anticompetitive effect shifts back to the government and merges with the ultimate burden of persuasion, which remains with the government at all times. *Anthem*, 855 F.3d at 350.

C. THE RELEVANT MARKET IS THE SALE OF CHLORIDE TIO2 IN NORTH AMERICA (UNITED STATES AND CANADA)

i. The Relevant Product Market Is Chloride TiO2 Sold to North American Customers

12. In a merger case, a relevant product market is the line of commerce in which competition may be substantially lessened because of the merger. *See Brown Shoe*, 370 U.S. 294, 324 (1962). The outer boundaries of a product market are determined by "the reasonable interchangeability of use or the cross-elasticity of demand between the product itself and substitutes for it." *Brown Shoe*, 370 U.S. at 325. Courts consider "whether there are other products offered to consumers which are similar in character or use . . . as well as how far buyers will go to substitute one commodity for another." *FTC v. Staples*, 970 F. Supp. 1066, at 1074 (D.D.C. 1997).

13. In defining an antitrust product market, courts consider "such practical indicia as industry or public recognition of the [relevant market] as a separate economic entity, the product's peculiar characteristics and uses, unique production facilities, distinct customers, distinct prices, sensitivity to price changes, and specialized vendors." *FTC v. Whole Foods Mkt., Inc.*, 548 F.3d 1028, 1037-38 (D.C. Cir. 2011) (quoting *Brown Shoe*, 370 U.S. at 325); *see also FTC v. CCC Holdings, Inc.*, 605 F. Supp. 2d 26, 38 (D.D.C. 2009).

14. Courts look to the "hypothetical monopolist test" as an analytical method for defining relevant markets. *FTC v. Penn State Hershey Med. Ctr.*, 838 F.3d 327, 338 (3d Cir. 2016); *FTC v. Staples II*, 190 F. Supp. 3d 100, 121-22 (D.D.C. 2016) (hereinafter "*Staples II")*. The test "queries whether a hypothetical monopolist who has control over the products in an alleged market could profitably raise prices on those products," typically using a small but significant and non-transitory increase in price ("SSNIP") of 5-10%. *Staples II*, 190 F. Supp. 3d at 121-22; *see also Horizontal Merger Guidelines* §§ 4.1.1-4.1.3. If imposing a SSNIP would not divert enough sales to sources outside the candidate market to render the price increase unprofitable, then the candidate market passes the test and comprises a relevant product market. *See Staples II*, 190 F. Supp. 3d at 121-22; *CCC Holdings*, 605 F. Supp. 2d at 38 n.12. Courts frequently have relied on the *Horizontal Merger Guidelines* framework to assess how acquisitions impact competition. *See, e.g.*, *Chicago Bridge & Iron Co. N.V. v. FTC*, 534 F.3d 410, 432 n.11 (5th Cir. 2008); *Heinz*, 246 F.3d at 716 n.9; *FTC v. Univ. Health Inc.*, 938 F.2d 1206, 1211 (11th Cir. 1991).

15. Complaint Counsel has established that the relevant product market for analyzing the Acquisition is chloride TiO2. No product is reasonably interchangeable with chloride

TiO2 that would allow chloride TiO2 customers to decrease their reliance on the product in sufficient quantities to render a SSNIP unprofitable. *See FTC v. Sysco*, 113 F. Supp. 3d 1, 33 (D.D.C. 2015). The evidence that Complaint counsel introduced to establish chloride TiO2 to be the relevant market included public disclosures of Respondent Tronox. *See* SEC Rule 10b-5 (17 C.F.R. § 240.10b-5) (which forbids, among other things, the making of any "untrue statement of a material fact" or the omission of any material fact "necessary in order to make the statements made . . . not misleading.").

16. For most customers in North America, sulfate TiO2 is not an effective substitute for chloride TiO2, because: 1) chloride TiO2 provides distinct performance advantages over sulfate TiO2 that are particularly important to North American customers; 2) due to these peculiar characteristics, North American customers cannot readily switch between sulfate and chloride TiO2; and 3) even when sulfate TiO2 is priced significantly less than chloride TiO2, North American customers cannot use these products as substitutes. *See Horizontal Merger Guidelines* §4.1.3.

ii. The Relevant Geographic Market Is North America (United States and Canada)

17. "The 'relevant geographic market' identifies the geographic area in which the defendants compete in marketing their products or services." *See FTC v. Cardinal Health, Inc.*, 12 F. Supp. 2d 34, 49 (D.D.C. 1998). The relevant geographic market must "correspond to the commercial realities of the industry" as determined by a "pragmatic, factual approach" to assessing the industry. *Brown Shoe*, 370 U.S. at 336.

18. "The boundaries of the relevant geographic market, like the boundaries of the relevant product market, depend on reasonable interchangeability and cross-elasticity of demand."

Polypore, 150 FTC 586, *15 (2010) (citing *Brown Shoe*, 370 U.S. at 336). "Where suppliers can set prices based on customer location, and customers cannot avoid targeted price increase through arbitrage, suppliers may be able to exercise market power over customers located in a particular geographic region, even if a price increase to customers located in other geographic regions would be unprofitable." *Polypore*, 150 FTC at *16 (*citing Horizontal Merger Guidelines* § 4.2.2).

19. As is true for defining a relevant product market, the principal economic analysis in defining a relevant geographic market is the hypothetical monopolist test. *See FTC v. Advocate Health Care Network*, 841 F.3d 460, 469 (7th Cir. 2016); *FTC v. Penn State Hershey Med. Ctr.*, 838 F.3d 327, 338 (3d Cir. 2016). In considering a targeted customer market, the hypothetical monopolist test analyzes whether a single firm controlling all the supply into a region could profitably impose a SSNIP on customers within the region. *See Polypore*, 150 FTC at *16; *see also Advocate*, 841 F.3d at 469; *Whole Foods*, 548 F.3d 1048; *Horizontal Merger Guidelines* § 4.2.2. Unless customers within the region can arbitrage to render the SSNIP unprofitable, the targeted market passes the hypothetical monopolist test. *United States v. Bazaarvoice, Inc.*, No. 13-cv-133, 2014 U.S. Dist. Lexis 3284 (N.D. Cal. January 8, 2014) (citing economic testimony that customers could not arbitrage to defeat targeted price increase and assessing market shares in U.S.).

20. It can be appropriate to define a relevant market based on sales to a distinct category of customers – in this instance North American customers. *See Staples II*, 190 F. Supp. 3d at 122 (product market defined around targeted "large [business-to-business] customers"); . *Sysco*, 113 F. Supp. at 38-48 (relevant targeted market for sales to "national customers");

Spirit Airlines, Inc., v. Nw. Airlines, Inc., 431 F.3d 917, 933-95 (6th Cir. 2005); (target product market defined as "leisure or price-sensitive passengers" rather than all passengers). "A price increase for targeted customers may be profitable even if a price increase for every customer would not be profitable because too many other customers would substitute away. When discrimination is reasonably likely, the Agencies may evaluate competitive effects separately by type of customer." *Guidelines* §§ 3, 4.1.4 ("If a hypothetical monopolist could profitably target a subset of customers for price increases, the Agencies may identify relevant markets defined around those targeted customers, to whom a hypothetical monopolist would profitably and separately impose at least a SSNIP").

21. Complaint Counsel has established that the appropriate geographic area within which to evaluate the probable competitive effects of the Acquisition is the United States and Canada ("North America"). Tronox, Cristal, and other suppliers compete to sell chloride TiO2 to customers across North America. Suppliers set prices based on customer location, and North American customers do not, and could not, avoid a SSNIP through arbitrage. In particular, the cost of shipping and duties imposes an additional cost of at least 10% on any customer that would attempt arbitrage. *See Hornsby Oil Co. v. Champion Spark Plug Co.*, 714 F.2d. 1384, 1394 (5th Cir. 1983) ("Whether ascertaining the scope of a geographic market or submarket, however, such economic and physical barriers to expansion as transportation costs, delivery limitations and customer convenience and preference must be considered.") Additionally, prices are set on a regional basis, and suppliers implement regional price announcements. *Monfort of Colorado v. Cargill*, 591 F. Supp. 683, 700 (D. Colo. 1983) ("region price differentials"

demonstrate that relevant markets are "regional in scope"). Moreover, North American customers overwhelmingly consume chloride TiO2 that is produced in North America.

D. THE ACQUISITION IS PRESUMPTIVELY UNLAWFUL BASED ON MARKET SHARES AND MARKET CONCENTRATION THRESHOLDS

22. A merger that significantly increases market shares and concentration is presumptively unlawful under Section 7 of the Clayton Act. *See United States v. Baker Hughes Inc.*, 908 F.2d 981, 982-83 (D.C. Cir.1990). By showing that a transaction will lead to undue concentration in the market for a particular product in a particular geographic area, the government establishes a presumption that the transaction will substantially lessen competition. *See United States v. Citizens & Southern Nat'l Bank*, 422 U.S. 86, 120-22 (1975); *see also Heinz*, 246 F.3d at 715.

23. The Commission may rely on "the closest available approximation" of market shares when calculating concentration levels. *See FTC v. PPG Indus.*, 798 F. 2d 1500, 1505 (D.C. Cir. 1986). Indeed, the "FTC need not present market shares and HHI estimates with the precision of a NASA scientist." *Sysco*, 113 F. Supp. 3d at 54 (market share estimates were reliable because they were the "closest available approximation"); *see also PPG Indus.*, 798 F.2d at 1505 (affirming finding of highly concentrated market based on comparison of market shares in a related market); *United States v. Bazaarvoice, Inc.*, No. 13-cv-133, 2014 U.S. Dist. LEXIS 3284, at *237 (N.D. Cal. Jan. 8, 2014) (shares are imperfect but reveal the basic market structure); *cf. Brown Shoe*, 370 U.S. at 340-41 ("fair sample" of markets sufficient to evaluate the merger).

24. Complaint Counsel introduced market share evidence based on sales revenues in the North American market for chloride TiO2. "Revenues in the relevant market tend to be

the best measure of attractiveness to customers, since they reflect the real-world ability of firms to surmount all of the obstacles necessary to offer products on terms and conditions that are attractive to customers." *Horizontal Merger Guidelines*, §5.2.

25. Courts employ a statistical measure called the Herfindahl-Hirschman Index (HHI) to measure market concentration. *See, e.g., Heinz,* 246 F.3d at 716. This index calculates market concentration by summing the squares of the individual market share of each market participant. *See Sysco*, 113 F. Supp. 3d at 52. Under the *Horizontal Merger Guidelines*, a merger is presumptively unlawful if it increases the HHI by more than 200 points and results in a post-merger HHI exceeding 2,500. *Merger Guidelines* § 5.3; *see also Heinz,* 246 F.3d at 716-17; *Sysco,* 113 F. Supp. 3d at 52; *Staples*, 970 F. Supp. at 1081-82.

26. Evidence presented at the hearing indicates that Tronox's proposed acquisition of Cristal would increase the HHI in the market for North American chloride process TiO2 by more than 600 points. It would result in a post-merger HHI in excess of 3,100 and a post-merger market share of greater than 30%. Therefore, the merger is presumed "likely to enhance market power," unless "rebutted by persuasive evidence." *See Heinz*, 246 F.3d at 716-17 (HHI increase of 510 points creates presumption of harm "by a wide margin").

27. The market shares and HHI levels here are comparable to the levels found to be unlawful by courts. In *FTC v. University Health, Inc.*, 938 F.2d 1206, 1219 (11th Cir. 1991), the court found that the FTC had "clearly established a *prima facie* case of anticompetitive effect" when it proved that a merger of two nonprofit hospitals would have reduced the number of competitors from five to four and resulted in a combined share of about 43 percent, an increase in HHI of over 630, and a post-merger HHI of

3200. *Univ. Health Inc.*, 938 F.2d at 1211 n.12, 1219. They far exceed levels that the Commission has found unlawful. *See Hosp. Corp. of Am. v. FTC,* 807 F. 2d. 1381 (7th Cir. 1986) (upholding Commission decision finding Section 7 violation where two acquisitions reduced number of competitors from 11 to 7, and increased the HHI to 2300); *In re The B.F. Goodrich Co.*, 1988 Lexis 16, at *66 (F.T.C. Mar. 15, 1988) (acquisition led to increase in HHI of 200-300 points, to just over 1600 at the highest, and Commission concluded that "the concentration data create a relatively strong presumption of anticompetitive effects").

E. THE ACQUISITION WOULD SUBSTANTIALLY LESSEN COMPETITION

28. Complaint Counsel has offered substantial evidence of anticompetitive effects resulting from the merger, any of which would independently mandate a finding against Respondent as a matter of law. The Acquisition violates Section 7 of the Clayton Act because "the effect of such acquisition may be substantially to lessen competition or to tend to create a monopoly." 15 U.S.C. § 18.

i. The Acquisition Increases the Likelihood of Coordination Among TiO2 Competitors

29. Merger law "rests upon the theory that, where rivals are few, firms will be able to coordinate their behavior, either by overt collusion or implicit understanding, in order to restrict output and achieve profits above competitive levels." *Heinz,* 246 F.3d at 715 (internal quotation marks omitted). Coordination includes conduct ranging from outright (unlawful) collusion, to tacit (lawful) coordination, to "parallel accommodating conduct," which "includes situations in which each rival's response to competitive moves made by others is individually rational… but nevertheless emboldens price increases and weakens competitive incentives to reduce prices." *Horizontal Merger Guidelines*, § 7.0. "Tacit

coordination is feared by antitrust policy even more than express collusion, for tacit coordination, even when observed, cannot easily be controlled directly by the antitrust laws. It is a central object of merger policy to obstruct the creation or reinforcement by merger of such oligopolistic market structures in which tacit coordination can occur." *Heinz*, 246 F.3d at 725 (emphasis added) (quoting 4 Phillip E. Areeda, Herbert Hovenkamp & John L. Solow, Antitrust Law ¶901b2, at 9 (rev. ed. 1998)).

30. The evidence presented at the hearing indicates that the market for North American chloride TiO2 is already highly concentrated, and the merger would significantly increase that concentration. High levels of concentration exacerbate the risk of coordination in the market. *See FTC v. Elders Grain, Inc.,* 898 F. 2d. 901, 905 (7th Cir. 1989) (acquisition from six to five makes it easier for leading members of the industry to collude on price and output); *FTC v. Univ. Health, Inc.*, 938 F.2d 1206, 1219 (11th Cir. 1991) (four remaining businesses could easily collude to raise price and decrease output without committing detectable violations of the Sherman Act).

31. In addition, the market for North American chloride TiO2 is already vulnerable to, and shows a history of, coordination. Decisions in *Valspar Corp. v. E.I. du Pont de Nemours & Co.*, 873 F.3d 185 (3rd Cir. 2017) and *In Re Titanium Dioxide Antitrust Litig*., 959 F. Supp. 2d 799 (D. Md. 2013), indicate likely previous coordination in the North American TiO2 market. In *Valspar*, the Third Circuit stated: "There is no dispute that the [TiO2] market was primed for anticompetitive interdependence and that it operated in that manner." *Valspar*, 873 F.3d 185 at 197. Likewise, the District Court of Maryland held that "[t]he record contains ample evidence for concluding that the [d]efendants agreed to

raise prices and shared commercially sensitive information . . to facilitate their conspiracy." *In re Titanium Dioxide Antitrust Litig.*, 959 F. Supp. 2d 799, 823 (2013).

32. As the Seventh Circuit explained in *FTC v. Elders Grain, Inc.*, "an acquisition which reduces the number of significant sellers in a market already highly concentrated and prone to collusion by reason of its history and circumstances is unlawful *in the absence of special circumstances*." 868 F.2d 901, 906 (1989) (emphasis added). *See H&R Block*, 833 F. Supp. 2d at 54 ("highly persuasive historical act of cooperation" demonstrates that parties are capable of acting in concert); *In re Autoparts Antitrust Litigation*, 29 F. Supp. 3d 982 (E.D. Mich. 2014) ("the length of the conspiracy alleged and the existence of market conditions conducive to antitrust conduct" supports a cognizable danger of recurrent violation).

33. Evidence presented at the hearing likewise demonstrates that the market for chloride TiO2 sales to North American customers is transparent and that Tronox, Cristal, and other TiO2 producers selling in North America have access to and use information regarding competitors' pricing and supply proposals. The evidence also establishes that the suppliers recognize their interdependence in the market. These major suppliers likewise provide significant information related to pricing decisions, projections, production levels, capacity utilization, and TiO2 inventories during regular earnings calls. Such regularly shared information makes competitive initiatives and decisions more transparent and predictable to other producers, and further serves to make the relevant market even more vulnerable to coordination. *See CCC Holdings*, 605 F. Supp. 2d at 61, 62, 65; *Merger Guidelines* § 7.2; *In re Delta/AirTran Baggage Fee Antitrust Litigation*, 733 F. Supp. 2d 1348, 1360 (N.D. Ga. 2010) ("Plaintiffs need not allege the existence of

collusive communications in "smoke-filled rooms" in order to state a § 1 Sherman Act claim. Rather, such collusive communications can be based upon circumstantial evidence and can occur in speeches at industry conferences, announcements of future prices, statements on earnings calls, and in other public ways.").

ii. The Acquisition Increases the Likelihood of a Unilateral Reduction in Chloride TiO2 Output

34. The combined firm would have not only the means to hold back chloride TiO2 from sales to North American customers, but also would have the incentive to suppress output unilaterally. *See United States v. Rockford Mem'l Corp*., 717 F. Supp. 1251, 1279 (N.D. Ill. 1989), aff'd, 898 F.2d 1278 (7th Cir. 1990). Unlike coordinated effects, unilateral output suppression assumes no cooperation from competing suppliers.

35. The *Merger Guidelines* explain that "[a] unilateral output suppression strategy is more likely to be profitable when (1) the merged firm's market share is relatively high; (2) the share of the merged firm's output already committed for sale at prices unaffected by the output suppression is relatively low; (3) the margin on the suppressed output is relatively low; (4) the supply responses of rivals are relatively small; and (5) the market elasticity of demand is relatively low." Merger Guidelines §6.3. Evidence presented at the hearing indicates all of these conditions are met here.

F. RESPONDENTS CANNOT REBUT THE STRONG PRESUMPTION OF ILLEGALITY OR COMPLAINT COUNSEL'S SHOWING OF LIKELY COMPETITIVE HARM

36. Respondents have the burden to rebut the presumption of illegality by "produc[ing] evidence that 'show[s] that the market-share statistics [give] an inaccurate account of the [merger's] probable effects on competition' in the relevant market." *Heinz*, 246 F.3d at

715 (alterations in original) (quoting *United States v. Citizens & S. Nat'l Bank*, 422 U.S. 86, 120 (1975)).

37. Respondents' burden is heavy, given the strength of Complaint Counsel's *prima facie* case. The stronger the *prima facie* case, the more evidence defendants must present to rebut the established presumption. *See Sysco*, 113 F. Supp. 3d at 23.

38. Respondents therefore needed to demonstrate "structural barriers," unique to this industry, that are sufficient to defeat the "ordinary presumption of collusion" that attaches to a merger in a highly concentrated market. *Heinz*, 246 F.3d at 725." Instead, however, the significant evidence of potential competitive harm presented at the hearing corroborates the competitive concerns that are at the core of the presumption.

i. Respondents Cannot Show That Entry or Expansion by Other Firms Will Counteract the Anticompetitive Effects of the Transaction

39. Respondents "carry the burden to show that ease of expansion is sufficient 'to fill the competitive void that will result if [defendants are] permitted to purchase' their acquisition target." *H&R Block*, 833 F. Supp. 2d at 73 (alterations in original) (quoting *Swedish Match*, 131 F. Supp. 2d at 169); *see also Staples*, 970 F. Supp. at 1086. Indeed, it is not enough that entry or expansion would replace "*some* of the competition" lost to the Merger. *See Swedish Match*, 131 F. Supp. 2d at 170 (emphasis added). Prospective "entry into the relevant market will alleviate concerns about adverse competitive effects only if such entry will deter or counteract any competitive effects of concern so the merger will not substantially harm customers." *Sysco*, 113 F. Supp. 3d at 80 (quoting *Merger Guidelines* § 9).

40. To meet their burden, Respondents must show that entry or expansion would be "'timely, likely, and sufficient in its magnitude, character, and scope to deter or counteract the competitive effects of concern.'" *H&R Block*, 833 F. Supp. 2d at 73 (quoting *Merger Guidelines* § 9); *see also CCC Holdings*, 605 F. Supp. 2d at 47.

41. Evidence presented at the hearing indicates that entry by any new TiO2 producer is unlikely. Moreover, expansion by producers based in China is unlikely to offset the competitive harms of the acquisition. Almost no chloride TiO2 comes from China to the North American market. Indeed, the vast majority of production in China is sulfate TiO2, which is outside the relevant market. "As with their other rebuttal arguments, Respondents bear the burden of demonstrating the ability of other distributors to 'fill the competitive void' that will result from the proposed merger." *Sysco*, 113 F. Supp. 3d at 80). Respondents must show at least a "reasonable probability of sufficient entry." *Chi. Bridge*, 534 F.3d at 430 n.10. *See also In re Chi. Bridge & Iron Co., 138 F.T.C. 1024, 1071 (2005)* ("the mere fact that new entrants and fringe firms have an intent to compete does not necessarily mean that those firms are significant competitors capable of replacing lost competition") And to the extent that uncertainty exists about potential future entry or expansion, "doubts are to be resolved *against* the transaction." *FTC v. Elders Grain, Inc.*, 868 F.2d 901, 906 (7th Cir. 1989) (emphasis added) (citing *Phila. Nat'l Bank*, 374 U.S. at 362–63).

ii. Respondents' Efficiencies Claims Do Not Rebut the Presumption of Illegality

42. Respondents bear the burden of proving cognizable efficiencies of a character and magnitude sufficient to ensure that the merger is not likely to be anticompetitive in any relevant market. *See H&R Block*, 833 F. Supp. 2d at 89; *Horizontal Merger Guidelines* §

10. Cognizable efficiencies must be merger-specific, verified, and not the result of anticompetitive reductions in output or service. *Horizontal Merger Guidelines* § 10. No court has ever relied on efficiencies to rescue an otherwise unlawful transaction. *See CCC Holdings*, 605 F. Supp. 2d at 72. Given the high market concentration levels in this case, Respondents need to present "proof of extraordinary efficiencies" to rebut the presumption of likely anticompetitive effects. *United States v. Aetna*, 240 F. Supp. 3d. 1, 98 (D.D.C. 2017), *citing Heinz*, 246 F.3d at 72

43. Claimed efficiencies are not cognizable unless they are (1) "merger-specific," and (2) "reasonably verifiable by an independent party." *Staples II*, 190 F. Supp. 3d at 137 n. 15. Respondents must prove "merger-specificity and verifiability" of all claimed efficiencies. *Anthem*, 855 F.3d at 364; *see also Heinz*, 246 F.3d at 722.

44. Respondents have failed to demonstrate that their claimed efficiencies are merger-specific because significant portions of their claimed cost savings appear to be achievable independent of the merger. *H&R Block*, 833 F. Supp. 2d at 90. Furthermore, most of the claimed efficiencies are out-of-market efficiencies, as they relate to products, sales and operations outside of the relevant market. *See Horizontal Merger Guidelines* § 10 n.14.; *see also Phila. Nat'l Bank*, 374 U.S. 371 (1963) (rejecting claim anticompetitive merger would bring benefits outside the relevant market); *Anthem, Inc.*, 855 F.3d at 363-64 (rejecting savings claims that, among other "analytic flaws," were "unmoored from the actual market at issue").

45. To be verifiable, the claimed efficiencies require "clear evidence showing that the merger will result in efficiencies that will offset the anticompetitive effects and ultimately benefit consumers." *Penn State Hershey*, 838 F.3d 327 at 350. It is incumbent upon

Respondents "to substantiate efficiency claims" so that an independent party "can verify by reasonable means the likelihood and magnitude of each asserted efficiency . . . and why each would be merger specific." *Horizontal Merger Guidelines* § 10. Respondents have failed to substantiate their asserted efficiency claims because they rely heavily on assumptions and on the business judgment of Tronox executives, and as such, are not subject to reasonable verification. *See H&R Block*, 833 F. Supp. 2d at 91 ("While reliance on the estimation and judgment of experienced executives about costs may be perfectly sensible as a business matter, the lack of a verifiable method of factual analysis resulting in the cost estimates renders them not cognizable by the Court.")

46. Further, Respondents must demonstrate that "the projected savings from the merger are enough to overcome the evidence showing that possibly greater benefits can be achieved by the public through existing, continued competition." *United States v. Aetna*, 240 F. Supp. 3d. 1, 98 (D.D.C. 2017), quoting *Sysco*, 113 F. Supp. 3d at 86.

47. Here, Respondents have failed to demonstrate proof of cognizable extraordinary efficiencies sufficient to rebut evidence of probable anticompetitive effects. Nor have Respondents presented any evidence that the claimed efficiencies would benefit customers. *FTC v. Univ. Health, Inc.*, 938 F.2d 1206, 1223 (11th Cir. 1991); *CCC Holdings*, 605 F. Supp. 2d at 74.

G. REQUESTED RELIEF

48. Complaint Counsel met its burden of proof in support of Count I and Count II of the Complaint.

49. Once Complaint Counsel has established a violation of Section 7, "all doubts as to the remedy are to be resolved in its favor." *United States v. E.I. du Pont de Nemours & Co.*, 366 U.S. 316, 334 (1961).

50. The Commission has broad discretion to select a remedy so long as it bears a "reasonable relation to the unlawful practice found to exist." *Jacob Siegel Co. v. FTC*, 327 U.S. 608, 611-13 (1946).

51. The proper remedy is an Order prohibiting any transaction between Tronox and Cristal pursuant to the Transaction Agreement between Tronox and Cristal.

52. The Order entered hereinafter is necessary and appropriate to remedy the violations of law found to exist.

Respectfully submitted,

Dated: August 14, 2018

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IN THE MATTER OF TRONOX/CRISTAL USA
DOCKET NO. 9377

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Dr. Ramsey Shehadeh	Expert in Finance, Accounting & Economics	Respondent Counsel's Expert	3194:15 - 3692:05	3447:01 - 3504:08 3507:01 - 3521:18 3614:01 - 3667:20 3683:01 - 3691:08	6/15/2018 6/20/2018 6/21/2018	Vol. 13 - 15
Kenneth Stern	Expert in Petroleum and Chemicals Industry	Respondent Counsel's Expert	3692:08 - 3898:19	3886:01 - 3896:10	6/21/2018 6/22/2018	Vol. 15 - 16
Willem Van Niekerk	Senior Vice President of Strategy	Tronox Limited	3898:22 - 4015:05	3963:01 - 3994:03 4010:01 - 4014:09	6/22/2018	Vol. 16

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COMPLAINT COUNSEL'S EXHIBIT INDEX

IN THE MATTER OF TRONOX/CRISTAL USA
DOCKET NO. 9377

COMPLAINT COUNSEL'S DEMONSTRATIVE INDEX

Exhibit No.	Description	BegBates	EndBates	Witness	Date Introduced	Trial Transcript Citation
PXD0001	United States v. Bazaarvoice, Inc., 2014 WL 203966 (N.D. Cal. Jan. 8, 2014)	PXD0001-001	PXD0001-069	Dr. Ramsey Shehadeh	6/20/2018	3555:23, 25; 3556:04; 3558:16; 3559:16; 3671:04
PXD0002	Universal Surveillance Corp. v. Checkpoint Systems, Inc., 2015 WL 6082122 (N.D. Ohio Sept. 30, 2015)	PXD0002-001	PXD0002-026	Dr. Ramsey Shehadeh	6/20/2018	3528:20; 3529:10; 3668:25; 3669:23; 3680:01, 13
PXD0003	Baker Jonathan B. (1987), Why Price Correlations Do Not Define Antitrust Markets: On Econometric Algorithms for Market Definition, Federal Trade Commission, Bureau of Economics, Working Paper No. 149.	PXD0003-001	PXD0003-058	Dr. Ramsey Shehadeh	6/20/2018	3595:03, 06, 17; 3596:10; 3597:05; 3675:18
PXD0004	Toda Hiro Y. (1995), Finite Sample Performance of Likelihood Ratio Tests for Cointegrating Ranks in Vector Autoregressions, Econometric Theory 11, 1015-1032	PXD0004-001	PXD0004-018	Dr. Ramsey Shehadeh	6/21/2018	3607:18, 20; 3608:04, 17; 3677:04, 17, 19

CERTIFICATE OF SERVICE

I hereby certify that on August 14, 2018, I filed the foregoing document electronically using the FTC's E-Filing System, which will send notification of such filing to:

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I also certify that I delivered via electronic mail a copy of the foregoing document to:

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Dated: August 14, 2018

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CERTIFICATE FOR ELECTRONIC FILING

I certify that the electronic copy sent to the Secretary of the Commission is a true and correct copy of the paper original and that I possess a paper original of the signed document that is available for review by the parties and the adjudicator.

August 14, 2018

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